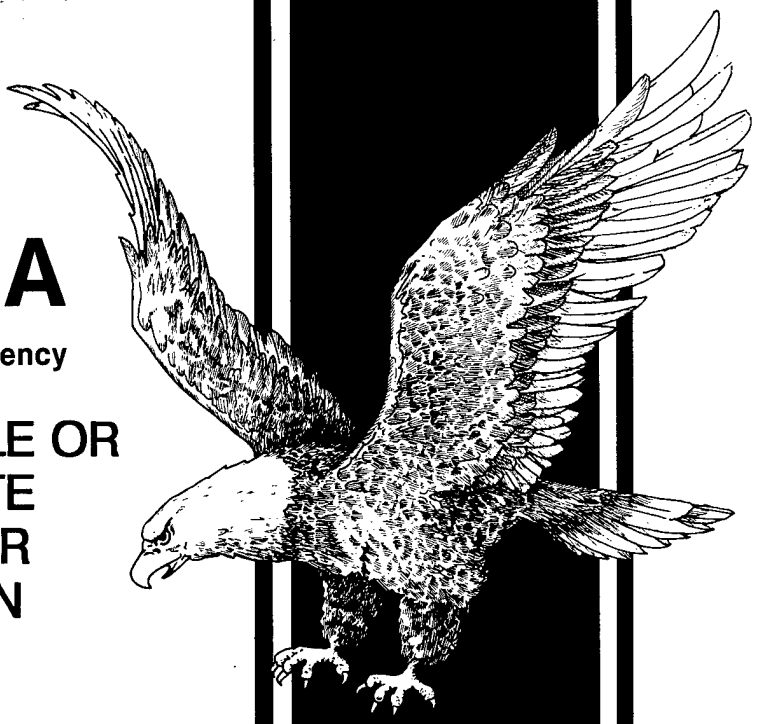

U S A T H A M A

U.S. Army Toxic and Hazardous Materials Agency

ASSESSMENT OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS) FOR ALABAMA ARMY AMMUNITION PLANT, ALABAMA

FINAL REPORT

CHEMICAL HAZARD EVALUATION PROGRAM
HEALTH AND SAFETY RESEARCH DIVISION
OAK RIDGE NATIONAL LABORATORY
OAK RIDGE, TN 37831-6050

May 24, 1990

U.S. ARMY TOXIC AND HAZARDOUS MATERIALS AGENCY
INSTALLATION RESTORATION DIVISION
ABERDEEN PROVING GROUND, MD 21010-5401

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ASSESSMENT OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS) FOR ALABAMA ARMY AMMUNITION PLANT, ALABAMA

1. INTRODUCTION

The Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA, Public Law 96-510) provided for "liability, compensation, cleanup, and emergency response for hazardous substances released into the environment and the cleanup of inactive waste disposal sites." The Superfund Amendments and Reauthorization Act (SARA, Public Law 99-499) provided extensive amendments to that act.

In particular, Title I, § 121 of SARA specifies that for any hazardous substance, pollutant, or contaminant that remains on-site, the level or standard of control that must be met shall be at least that of any legally applicable or relevant and appropriate regulation (ARAR), standard, criteria, or limitation under any federal environmental law or any more stringent standard promulgated under state environmental or facility siting law.

The U.S. Army Toxic and Hazardous Materials Agency (USATHAMA) has asked the support of the Chemical Effects Information Task Group in the Chemical Hazard Evaluation Program at Oak Ridge National Laboratory (ORNL) for assistance in determining ARARs for Alabama Army Ammunition Plant (AAAP), currently listed on the National Priorities List (NPL) (52 FR 27620, July 22, 1987). Supporting documentation for this report includes the Alabama Army Ammunition Plant Installation Assessment (USATHAMA 1978); the final remedial investigation (RI) (ESE 1986); the final feasibility study (FS)(ESE 1987); and the remedial action reports by Weston (1987, 1988).

AAAP is located in northeastern Alabama, 40 miles southeast of Birmingham and 4 miles north of Childersburg. Operations conducted during the 1940s included manufacture of the munitions compounds trinitrotoluene (TNT), nitrocellulose (NC), dinitrotoluene (DNT), and tetryl. Also manufactured at AAAP were sulfuric acid, aniline, N,N-dimethylaniline, and diphenylamine. AAAP was originally divided into three areas: the Leaseback Area, the GSA Area, and the Industrial Area. For the purpose of the RI/FS work, the installation was redefined as consisting of Areas A and B (ESE 1986). Area A has been designated for release and sale to private individuals; Area B consists primarily of the original Industrial Area and currently has limited access to hunters and loggers (ESE 1987).

As a result of the past activities at AAAP, the soils and sediments on the installation are contaminated with munitions compounds, degradation products of the munitions, and heavy metals. The primary site of concern in Area A is the Old Burning Ground (Study Area 12). However, the contaminated soils in Area A have been excavated and transported to Area B where they are currently stored in slab and awaiting incineration. Therefore, the primary area of concern addressed in this document will be

Area B. The primary sites of concern in Area B are the Sanitary Landfill and Lead Facility (Study Area 3), the Northern and Southern TNT Manufacturing Areas (Study Areas 6 and 7), the Tetryl Manufacturing Area (Study Area 10), the Flashing Ground (Study Area 16), the Lead Remelt Facility (Study Area 19), the Red Water Ditch (Study Area 21), and the Beaver Pond Drainage System (Study Area 27).

The western edge of AAAP is adjacent to the Coosa River; groundwater flow is predominantly to the west-northwest, toward the Coosa River. The residences located within two miles of the installation may use private drinking water wells, but none are downgradiant from the plant. The city of Childersburg utilizes deep wells for its municipal water supply, with the closest municipal well 2.2 miles south of the installation boundary. Approximately 65 percent of surface water drainage is conveyed by three drainage systems, all of which flow toward the Coosa River. Two of these are natural systems (Beaver Pond Drainage System and the Crossover Ditch) and the third is man-made (Red Water Ditch). Surface runoff from the southern and eastern side of AAAP is via Talladega Creek, which flows into the Coosa River. No defined streams flow easterly from AAAP (ESE 1986).

Contamination of the shallow aquifer in the Industrial Area has occurred as a result of the leaching of munitions compounds from the soils and sediments at AAAP. However, the existing groundwater data is too sketchy to determine the extent of this contamination. Additional monitoring is being planned to better define this problem (Edwards 1989). Therefore, this report will address the problems at AAAP by focusing on the existing data for soils and sediments. When the additional groundwater data become available, this report will be revised, if necessary.

2. SELECTION OF ARARs

Selection of ARARs is dependent on the hazardous substances present at the site, the site characteristics and location, and the actions selected for a remedy. Thus, these requirements may be chemical-, location-, or action-specific. Chemical-specific ARARs are health- or risk-based concentration limits set for specific hazardous substances, pollutants, or contaminants. Location-specific ARARs address such circumstances as the presence of an endangered species on the site or the location of the site in a 100-year floodplain. Action-specific ARARs control or restrict particular types of remedial actions selected as alternatives for cleanup of the site.

2.1 CHEMICAL-SPECIFIC ARARs

The Superfund public health evaluation process is composed of two phases: 1) the baseline public health evaluation and 2) the development of health-based performance goals for proposed remedial alternatives. The process is fully described in the USEPA Superfund Public Health Evaluation Manual (SPHEM) (USEPA 1986). The first step in the baseline public health evaluation process at Superfund sites is the selection of chemicals of concern or "indicator chemicals". This procedure identifies the chemicals that pose the greatest potential public health risk at a site and is based

on site monitoring data, chemical toxicity information in the form of toxicity constants developed by EPA, and environmental persistence and mobility of the chemicals.

Chemical-specific ARAR's or "to be considered" (TBC) guidance values are subsequently selected for the development of health-based performance goals (i.e., cleanup levels for contaminated soil or groundwater) in the form of a baseline risk assessment. The methodology outlined in the revised SPHEM (USEPA 1989) or the Preliminary Pollutant Limit Value (PPLV) methodology of Rosenblatt and Small (1981) may be utilized to quantitate exposure pathways and risk to individuals from exposure via the pathways of concern at a particular site.

2.1.1 Indicator Chemicals

We have developed the list of indicator chemicals for soils at AAAP following the guidelines outlined in Chapter 3 of SPHEM (USEPA 1986). Initially, a concentration-toxicity screening procedure, as outlined in SPHEM, was used to obtain a relative ranking of detected chemicals based on indicator score (IS). A microcomputer-based spreadsheet was used to automate the routine features of the procedure. The IS for each chemical was calculated as the sum of the representative concentration times the oral toxicity constant for soil. The most current toxicity constants used to derive the IS for each chemical were provided by the Environmental Criteria and Assessment Office, EPA, Cincinnati. These numbers are listed in the EPA Public Health Risk Evaluation Database (PHRED) (USEPA 1988a). The Indicator Chemical worksheets, which show the calculation of the indicator scores are presented in the Appendix.

The top-scoring chemicals in the screening procedure, along with any detected chemicals for which toxicity constants are currently unavailable, were subsequently analyzed to establish a list of the chemicals posing the most significant health risks at the site. Final selection of indicator chemicals was based on evidence of human carcinogenicity, frequency of occurrence in environmental media, exceedance of acceptable intake values, exceedance of background levels, and environmental persistence and mobility.

Complete historical monitoring data for soil and sediments at AAAP were obtained from the Installation Restoration Data Management System maintained at USATHAMA. All monitoring data have been quality assurance/quality control validated by USATHAMA. When the additional groundwater monitoring data become available, the list of indicator chemicals will be reevaluated to incorporate this information. A total of 38 chemicals were detected in soil or sediment samples obtained from AAAP from 1980 to 1982 and 1985 to 1987.

Potential carcinogens and noncarcinogens were ranked by their indicator score, and three indicator chemicals (2,4-DNT, 2,6-DNT, and lead) were selected from the top-scoring compounds. Two additional munitions compounds (2,4,6-TNT and tetryl), for which toxicity constants are currently unavailable, were also selected as indicators because of

their occurrence in AAAP soils and sediments at high concentrations. In addition, 1,3,5-trinitrobenzene (TNB), a degradation product of TNT, was selected as it occurred in soils at seven different locations at AAAP; concentrations measured were relatively low, with the highest (3.92 mg/kg) occurring at the Flashing Ground (Study Area 16). A list of the indicator chemicals and supporting data is presented in Table 1.

The mixture of 2,4- and 2,6-DNT is classified as a B2 carcinogen (probable human carcinogen), as is 2,4-DNT alone (USEPA 1988b). The toxicity constant for 2,6-DNT listed in PHRED (USEPA 1988a) was developed based on its noncarcinogenic effects. However, recent studies have shown that the 2,6-isomer is a potent hepatocarcinogen (Leonard et al. 1983, 1987). 2,4,6-TNT has recently been classified by EPA as a Group C carcinogen (USEPA 1989a).

The primary areas of concern at AAAP are the Northern and Southern TNT Manufacturing Areas. ESE (1986) reports that approximately 65,300 m^2 of soil in these areas are contaminated with the following munitions compounds: 2,4,6-TNT (with concentrations up to 7,900 $\mu g/g$), 2,4-DNT (with concentrations up to 16.0 $\mu g/g$), and 2,6-DNT (with concentrations up to 16.1 $\mu g/g$). The majority of contamination occurs in the upper 1.0 m of the soil. The DNTs are the most labile of these compounds with an estimated half-life of 6 years in the upper 1 ft of soil at AAAP (ESE 1986). However, 2,4,6-TNT undergoes photolysis and breaks down to the DNTs, TNBs, and dinitrobenzenes; consequently, these compounds are released into the surrounding soils. 1,3,5-TNB has been detected in soils in these study areas at concentrations up to 2.8 $\mu g/g$. The soils of the Flashing Ground (Study Area 16) are also contaminated with these munitions compounds and their degradation products. With the exception of 1,3,5-TNB, which was detected at a concentration of 3.9 $\mu g/g$, the compounds occur in lower concentrations in this study area.

Lead contamination is greatest in the soils of the Sanitary Landfill and Lead Facility (Study Area 3) and the Lead Remelt Facility (Study Area 19), with concentrations as high as 13,410 $\mu g/g$ and 14,740 $\mu g/g$, respectively. Tetryl contamination is primarily confined to the soils of the Tetryl Manufacturing Area (Study Area 10), occurring at concentrations up to 13,700 $\mu g/g$.

Several other heavy metals, including nickel, copper, zinc, total chromium, and mercury, ranked among the top 10 noncarcinogens; however, they were not selected as indicators because they were detected infrequently and at concentrations below guidance values for acceptable intake levels from soil ingestion[1].

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[1]Estimated using a Reference Dose (USEPA 1988b) and an assumed soil ingestion rate of 0.2 g/day for a 10-kg child (USEPA 1989b).

Table 1. Indicator Chemicals Selected for Alabama Army Ammunition Plant

Chemical	Indicator Scoring Rank[a]	Soil: Representative Concentration (mg/kg)	Soil: Total Number of Occurences	Sediment: Representative Concentration (mg/kg)	Sediment: Total Number of Occurences
2,4-DNT[b]	5[c] 10[d]	1.6	43	1.2	12
2,6-DNT[b]	8[d]	2.2	14	0.6	5
Lead	1[d]	356	310	52	63
Tetryl	NA[e]	2442	7	1.3	1
1,3,5-TNB[f]	NA[e]	1.5	11	1.3	2
2,4,6-TNT[g]	NA[e]	569	45	3.8	9

[a]Rank is based on the indicator score which is equal to the sum of the representative concentration times the toxicity constant across all media.
[b]DNT = dinitrotoluene.
[c]Based on carcinogenic effects.
[d]Based on noncarcinogenic effects.
[e]NA = Not available. Information concerning toxicity is presently insufficient; toxicity constant not available.
[f]TNB = trinitrobenzene.
[g]TNT = trinitrotoluene.

During operations at AAAP, the man-made Red Water Ditch carried wastes from the primary munitions manufacturing areas to the Coosa River. Consequently, the sediments and spoil banks along this drainage are highly contaminated with these munitions compounds. Contamination from this system and from the soils of Areas 6 and 7 has migrated into the shallow aquifer underlying the Industrial Area. These compounds have been detected in groundwater at concentrations of 21,960 μg/L for 2,4,6-TNT, 4,342 μg/L for 2,4-DNT, 1,085 μg/L for 2,6-DNT, and 4,494 μg/L for 1,3,5-TNB. The Beaver Pond Drainage System is located between Areas 6 and 7 and mixes with the Red Water Ditch System. Both of these drainages flow into the Coosa River, thereby presenting the potential for off-post migration of these contaminants. In addition, the contaminated aquifer provides groundwater recharge to the surface waters of these areas (ESE 1986). The additional on- and off-post groundwater monitoring scheduled for this year should provide a better understanding of the contamination potential for this site.

2.1.2 Federal and State ARARs

There are at present no federal or Alabama state health-based ARARs that specify acceptable concentrations for cleanup of contaminated soils.

2.1.3 Other Guidance to be Considered

There are no available health-based guidance values for cleanup of nitroaromatics and metals in soils. However, Rosenblatt and Small (1981) have estimated acceptable concentrations of these compounds in soil that will result in no adverse health effects for several land use scenarios at AAAP. The basic equation utilized in the Preliminary Pollutant Limit Value (PPLV) approach of Rosenblatt and Small is:

$$C_S = \frac{BW \times D_t}{IR \times K},$$

where

C_S = the concentration in soil resulting in no adverse health effects following consumption of a particular pollutant, mg/kg;

BW = body weight, kg;

D_t = acceptable daily dose to humans, mg/kg/day;

IR = ingestion rate, kg/day; and

K = partition coefficient to reflect uptake from soil to matter ingested by man, unitless.

The PPLV methodology was applied to five pathways of exposure: ingestion of vegetables, meat (pork, beef, and venison), dairy products, and soil[2]; and dust inhalation. These pathways were then summed in various selected combinations to estimate the concentration in soil that would not cause adverse health effects in humans following exposure in various scenarios (residential housing, hunting, logging, etc.). Input parameters for the various pathways of exposure have been presented in the report by Rosenblatt and Small (1981). In the case of the nitroaromatics and metals, D_t was estimated from the best available information, whether in the form of a threshold limit value (TLV), ambient water quality criteria, or no observed effects level in animal studies.

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[2]Rosenblatt and Small (1981) use a soil ingestion rate for children of 0.1 g/day. However, guidance from EPA in estimating exposures from contaminated soils recommends soil ingestion rates of 0.2 g/day for children aged 1 to 6, and 0.1 g/day for older age groups (USEPA 1989b).

EPA has listed health-based numbers in the form of Reference Doses (RfDs), acceptable chronic intakes, or carcinogen potency factors for several of the compounds found at AAAP (USEPA 1988b), and these values are presented here as "to be considered" (TBC) guidance for inclusion in the PPLV calculations for AAAP (see Table 2). Also listed in the table are the original D_t and PPLV values derived by Rosenblatt and Small (1981) for the most restrictive scenario, that of residential housing, and the soil detection limits for the compounds selected as indicator chemicals at AAAP (Weston 1988).

2.1.4 Conclusions

Table 2 lists PPLV values for cleanup of contaminated soil as well as USATHAMA certified detection limits for the indicator chemicals at AAAP. Values "to be considered" for cleanup of contaminated soils at AAAP are underlined in the table. As can be seen from the table, the analytical detection limits for the DNTs exceed the PPLV concentration in soil estimated to be protective of human health assuming the most conservative exposure scenario (residential housing). Recalculation of the PPLV determined by Rosenblatt and Small (1981) using the more current RfD values would result in still lower PPLVs. Therefore, for these munitions compounds, in the absence of any federal or state-promulgated values for cleanup of contaminated soils, these detection limits should be used as TBC guidance.

In the case of lead and 2,4,6-TNT, the PPLV methodology of Rosenblatt and Small (1981) seems appropriate to use as TBC guidance, assuming that these values are adjusted to reflect the more current health-based RfDs and utilizing EPA-approved ingestion parameters. Although these revised PPLVs are not presently available, it appears that for lead, use of the revised PPLV will dictate cleanup levels, and for 2,4,6-TNT, the detection limit will be the appropriate cleanup level.

Tetryl and 1,3,5-TNB do not have any more current health-based values to use as guidance in estimating PPLVs, and so the PPLVs reported by Rosenblatt and Small (1981), which are higher than the analytical detection limits, are all that are available to determine cleanup levels for contaminated soils. Adjustment of these PPLVs by assuming a child's soil ingestion rate of 0.2 g/day rather than 0.1 g/day might reduce them somewhat, but they will still in all likelihood be higher than the detection limits.

Table 2. To Be Considered (TBC) Guidance for Cleanup of Contaminated Soils at Alabama Army Ammunition Plant

Indicator Chemical	D_t[a] (mg/kg/day)	USEPA Dose[b] (mg/kg/day)	PPLV[c] (mg/kg)	Detection Limit (mg/kg)[d]
2,4-DNT	3.2 E-05[e]	1.5 E-06[f]	0.03	0.424
2,6-DNT	3.2 E-05	NA[g]	0.03	0.524
Lead	8.0 E-03	1.4 E-05[h]	177	0.177[i]
2,4,6-TNT	1.4 E-05	5.0 E-04[j]	0.013	0.456
Tetryl	1.8 E-03	NA	1.7	0.731
1,3,5-TNB	5.8 E-03	NA	5.5	0.488

[a]Acceptable daily dose as derived by Rosenblatt and Small (1981).
[b]The dose for noncarcinogens which will result in no adverse health effects or for carcinogens which will result in one excess cancer in a million people following lifetime ingestion of contaminated soil.
[c]Preliminary Pollutant Limit Value (Rosenblatt and Small 1981).
[d]USATHAMA Certified Method 11W12 using HPLC (Vondrick 1989).
[e]Read as 3.2×10^{-3}.
[f]The daily intake that will result in one excess cancer in a million people following lifetime ingestion of contaminated soil. Derived from a carcinogen potency factor (See footnote [3] below).
[g]NA = not available.
[h]Acceptable Intake Chronic (AIC) (USEPA 1986).
[i]USATHAMA Certified Method using a graphite furnace (Vondrick 1989).
[j]Reference Dose (USEPA 1989b).

[3]2,4-DNT is considered by EPA to be a Group B2 carcinogen. An oral carcinogen potency factor of 6.8 E-01 $(mg/kg/day)^{-1}$ is available for DNT (USEPA 1988b). A dose of 1.5 E-06 mg/kg/day would result in one excess cancer among one million persons from incidental exposure to 2,4-DNT in the soil (an excess cancer risk of 1×10^{-6}), derived in the following fashion:

$$\text{Dose (mg/kg/day)} = \frac{10^{-6}}{q_1^* \ (\text{mg/kg/day})^{-1}},$$

where

10^{-6} = selected risk level;
q_1^* = oral carcinogen potency factor.

2.2 LOCATION-SPECIFIC ARARs

Location-specific ARARs set restrictions on remedial action activities depending on the characteristics of a site or its immediate environs. Much of the information regarding characteristics of the AAAP was provided by officials of the State of Alabama. Table 3 lists location-specific ARARs as discussed below.

2.2.1 Caves, salt-dome formations, salt-bed formation, and underground mines

The plant is underlain by dolomites and limestones of the Knox Group of Cambro-Ordovician Age. Both rock types are carbonated rocks which could be subject to cave formation (Osborne 1989). There are no salt-bearing units within the Knox Group, and salt domes and underground mine formations are not present (Osborne 1989). Kymulga Cave and Desota Caverns in Section 12, Township 20, are located within a few miles of the plant (Alabama Geological Survey 1988). The U.S.G.S. map of sinkhole-prone areas in Talladega shows two sinkholes within the present boundaries of the plant; one of the sinkholes has a maximum dimension greater than 0.2 mile (Alabama Geological Survey 1977). Construction projects in this area encountered sinkholes during 1978 (USATHAMA 1978).

Areas underlain by limestone are subject to cave formation and sinkhole development. Therefore, if any remedial action alternatives are contemplated in these areas, the Resource Conservation and Recovery Act (RCRA) regulations found in Table 3 may be relevant and appropriate.

2.2.2 Faults

Based on discordant structural orientations, a pre-Holocene thrust fault may be present approximately 2 miles south of the southern boundary of the plant (Alabama Geological Survey 1988). Although the existence of this fault appears likely, it is not visible in the outcrop. The area is very complex structurally, and both isoclinal folds and small-scale faults have been seen in outcrops along the west bank of the Coosa River in Section 30, Township 19 South, Range 3 East (Osborne 1989). Also, rocks in the Lambert quarry of Section 5, Township 21 South, range 3 East contain abundant upright chevron folds cut by steep ancient (pre-Holocene) faults (Alabama Geological Survey 1988). There are no reports of any recent movement of any faults in this area, so it can be concluded that the faults in the AAAP are stable (Osborne 1989).

2.2.2 Wilderness areas, wildlife refuges, and scenic rivers

The west boundary of the Talladega Division of the Talladega National Forest is approximately 15 miles to the east of AAAP. The Hollins Wildlife Management Area is located in this area of the Talladega National Forest. The Cheaha Wilderness is located approximately 40 miles to the northeast of the installation, within the Talladega National Forest. However, there are no wilderness areas, wildlife refuges, or scenic rivers inside the Depot (Brown 1989).

Table 3. Selected location-specific applicable or relevant and appropriate requirements for Alabama Army Ammunition Plant[a]

Location	Requirement	Prerequisite(s)	Citation
Within 100-year floodplain	Facility must be designed, constructed, operated, and maintained to avoid washout by a 100-yr flood	RCRA[b] hazardous waste; treatment, storage, or disposal	40 CFR 264.18(b)
Within floodplain	Must take action to avoid adverse effects, minimize floodplain destruction, restore and preserve natural and beneficial values, and minimize impact of floods on human safety, health, and welfare	Action of Federal agencies pertaining to: acquiring, managing, and disposing of lands and facilities; construction or improvements; and conducting activities and programs affecting land use in flood-prone areas	Executive Order 11988; Floodplain Management (40 CFR 6, Appendix A);
Wetland	Action to avoid adverse impact, minimize potential harm, and to preserve and enhance wetlands to the extent possible	Wetland as defined 40 CFR 6, Appendix A, § 4; Action by federal agencies involving construction of facilities or management of property in wetland areas	Executive Order 11990; Protection of Wetlands (40 CFR 6, Appendix A)
Wetland	Prohibits discharge of dredge or fill material into wetlands without permit		Clean Water Act § 404; 40 CFR 230.10; 33 CFR 320-330
Within salt dome formation, salt bed formation, underground mine, or cave	Prohibits placement of non-containerized or bulk liquid hazardous waste	RCRA hazardous waste	40 CFR 264.18(c)

Table 3. (Continued)

Location	Requirement	Prerequisite(s)	Citation
Critical habitat upon which endangered or threatened species depends	Action to conserve endangered or threatened species; must not destroy or adversely modify critical habitat; consultation with Department of Interior	Determination of presence of endangered or threatened species	Endangered Species Act of 1973 (16 USC 1531 et seq.); 50 CFR 402
Within area affecting stream or river	Must take action to protect affected fish or wildlife resources; prohibits diversion, channeling, or other activity that modifies a stream or river and affects fish or wildlife	Presence of fish and wildlife resources	Fish and Wildlife Coordination Act (16 USC 661 et seq.)

[a]Adapted from USEPA (1988).
[b]RCRA = Resource Conservation and Recovery Act.

2.2.4 Wetlands and floodplains

The majority of the surface runoff from AAAP drains either west or southwest into the Coosa River (USATHAMA 1978). A small portion of the southern and eastern side of AAAP drains toward the Talladega Creek, a tributary of the Coosa River. Extensive wooded swamp and open pond areas have developed in the drainage systems at AAAP since the beginning of demolition activities in 1973, primarily as a result of damming of drainways by beaver (Garland 1989). Beaver Pond and various watering ponds found at AAAP are actively being utilized by beaver and other animals.

Information concerning identification and location of wetlands is not available at this time from the U.S. Fish and Wildlife Service nor the Alabama Department of Conservation and Natural Resources (Raoscigno 1989; Hayden 1989). If remedial actions are contemplated that would impact the wetlands areas, a wetland installation assessment should be implemented (Hayden 1989).

Floodplains exist near Talladega Creek and near the Coosa River. The Talladega Floodplain Map indicates areas in the 100-year floodplain near the southern portion of the plant adjacent to the Southern Railway Highway (FEMA 1988a). On the western side of the facility near the Coosa River some areas are subject to flooding on both sides of State Highway 225 (Wright 1989). In addition, part of the installation appears to be in the floodplain further north in an area west of Highway 235 and East of the Seabord Coastline Railway, (Wright 1989). Along the Coosa River there are floodplains on both sides of Ordnance Road, to the east and north junction of Talladega Creek with the Coosa River (Wright 1989; FEMA 1988b).

If any remedial actions are contemplated that would impact the wetlands or floodplain areas, the regulations found in Executive Order (E. O.) 11990, the Clean Water Act § 404, E. O. 11998, and 40 CFR 264.18(b) may be ARARs (See Table 3). In addition, remedial activities impacting any of the wildlife found on the installation may be subject to regulations found in the Fish and Wildlife Coordination Act (Table 3).

2.2.5 Historic sites and archaeological findings

There are 17 known archaeological sites within the immediate vicinity of the plant and many more within a few miles of the ordinance site (Oaks 1989). Of the known archaeological sites, 5 are potentially eligible for the National Register of Historic Places. The other sites would require further testing to determine eligibility (Oaks 1989).

There has not been a historic structure survey for this area and therefore no known structures that are listed on the site are eligible for the National Historic Register of Historic Places. The possibility for eligible structures does exist and the plant itself should be evaluated according to Alabama Historical Commission staff (Oaks 1989). If any remedial action is taken that would affect the preservation of any

archaeological findings at AAAB the National Archeological and Historical Preservation Act may be ARAR (See Table 3).

2.2.6 Rare, threatened or endangered species

A large variety of fauna and flora can be found in Talladega and Calhoun Counties. Vertebrate species include 27 amphibians, 46 reptiles, 192 birds, and 48 mammals (USATHAMA 1978). The red-cockaded woodpecker, Picoides borealis (vieillot) is listed as an endangered species by the United States Department of the Interior (USATHAMA 1978) and the state of Alabama (Mount 1986). If any remedial action is taken that would destroy this species or adversely modify its critical habitat, regulations found in the Endangered Species Act of 1979 may be considered ARARs (See Table 3).

2.3 ACTION-SPECIFIC ARARs

Action-specific ARARs are usually technology- or activity-based requirements or limitations on actions taken with respect to hazardous wastes. These requirements are triggered by the particular remedial activities that are selected to accomplish a remedy. For site activities that are in the RI/FS stage, a multiplicity of action-specific ARARs will apply to the remedial alternatives under consideration. Additionally, if the remedial alternative that has been selected involves sequential integrated actions, the design and implementation of each step will be governed by action-specific ARARs. Certain ARARs represent hybrids between chemical-, location-, and action-specific ARARs. These hybrid ARARs involve an action taken with respect to a specific constituent or location. Effluent discharge limits or air emission standards are considered hybrids between action-specific and chemical-specific ARARs because an action (i.e., a discharge) is taken with respect to a chemical.

As discussed in the introduction, AAAP was involved in the production of nitrocellulose, TNT, and tetryl. Chemical intermediates used in the manufacturing of these explosives, including aniline, diphenylamine, dinitrotoluene (DNT) and dimethyl aniline were also produced. Residues, off-specification materials, and wastewaters from these production activities were stored and disposed of at AAAP in the section delineated as Area B. Certain portions of Area B are contaminated with tetryl and TNT to such an extent that these soils are characteristically reactive (D003) under RCRA. Additionally, widespread low concentration contamination of soils and groundwaters by nitramines and nitroaromatics exists. The Red Water Storage Basin (Study Area 5) and Red Water Ditch (Study Area 21) received wastewaters and sludges from TNT manufacturing listed as K047 and K044, respectively. The majority of the reactive soils occur in the vicinity of the Red Water Ditch (spoil banks area) as a result of dredging the sludge from the ditch and basin. Under 40 CFR 261.3, any solid waste derived from the treatment, storage or disposal of a listed hazardous waste remains that listed waste. The residues, sludges, and wastewaters that were placed in the basin and ditch met the listing criteria at the time of placement and, therefore, the contaminated sediments derived from that activity are considered RCRA-listed wastes. The fact that certain of these residues no longer exhibit the characteristic of reactivity is irrelevant to the determination that the listing is applicable because the wastes were not mixed to eliminate the characteristic at the time of generation or placement in these areas. Under RCRA, the listing remains applicable unless the sediments are delisted.

Aniline and related organics were manufactured in Study Area 8. Residues from the manufacturing operations were disposed of in the Aniline Sludge Basin (Study Area 9). Sampling results in the RI/FS document do not include aniline or its manufacturing intermediates among the indicator chemicals for this study area. It is suspected that the residues disposed of in the sludge basin met the RCRA listings K083, K103, or K104 for certain process residues and wastewaters from aniline production. If the wastes disposed of in this basin met the listing criteria, the soils, sediments, or residues would be considered RCRA-listed wastes. For the

purpose of this document, the listing criteria is assumed to be met.

AAAP was proposed for listing on the NPL in October 1984 and finalized in July 1987. As a result of listing on the NPL, the remediation at AAAP must comply with ARARs derived from federal and state environmental laws. Although on-site treatment at NPL sites is exempt from permit requirements, the substantive standards derived from environmental laws may continue to apply as ARARs.

Several remedial actions for the soils and groundwaters of Area B were explored in the RI/FS document (ESE 1987). These alternatives included (1) off-site treatment and/or disposal, (2) removal of soils, etc., followed by on-site disposal in a secure landfill, (3) removal of soils for on-site incineration combined with extraction treatment and injection of groundwater, (4) capping of contaminated zones and (5) no-action. Action-specific ARARs for the first four alternatives are provided in Tables 4 through 7. Each alternative is further defined in subsequent sections.

The remedial actions that were explored in the RI/FS satisfy the prerequisites of several environmental laws. Every alternative except for the no-action plan consists of moving and treating the RCRA-listed wastes, which triggers the jurisdictional criteria of RCRA for generation, treatment, and disposal of a RCRA-listed waste. The jurisdictional criteria for discharges to the surface waters of the United States are met under certain alternatives and invoke requirements pursuant to the Federal Water Pollution Control Act (FWPCA). Additionally, the alternative of groundwater extraction, treatment, and injection involves requirements of the Underground Injection Control (UIC) program of the Safe Drinking Water Act.

2.3.1 Preliminary Decontamination Activities

Prior to initiation of any of the five studied alternatives, preliminary decontamination activities are planned for portions of Area B. These actions involve removal of the most severe contamination to allow flexibility in the cleanup approach and ensure safe work zones for remedial personnel. These preliminary decontamination actions include removal and flashing of contaminated sewer lines and spoil bank residues. Removal of friable asbestos contained in rubble piles will also be performed in the preliminary activities.

Requirements for open burning of explosives are found under RCRA interim status standards for thermal treatment (40 CFR 265.370 et seq.). Permitting standards for miscellaneous units (40 CFR 264.600 et seq.) are also applicable to open burning of waste explosives. The interim status standards establish requirements for waste analysis, inspection, operation and closure.

Under the general waste analysis requirements of 40 CFR 265.13, the sampling plan must ensure that the data will be representative and account for possible variations in the waste. In addition to the general waste

analysis requirements, the thermal treatment operator must determine the BTU sulfur and halogen content of the waste. Concentrations of lead and mercury must be determined unless documented evidence exists to indicate these constituents are not present. At AAAP, it is likely that it can be demonstrated that mercury is not present. These requirements are considered applicable to flashing the spoil pile residues and sewer lines because the type of activity, type of waste, and jurisdictional prerequisite of treating RCRA wastes after 1980 are met.

Inspection of all operating equipment, ancillary equipment, process monitoring and control instrumentation, emission control systems, and the plume are required during thermal treatment or on a daily basis. Emergency shutdown systems and alarms must be inspected daily to ensure proper operation. Due to the anticipated nature of the flashing operation, many of the requirements cannot be directly applied. It is expected that the flashing will be conducted with portable devices such as "flame throwers" or torches. For these systems, daily inspection of the fuel systems, igniters, piping, valves, nozzles, and instrumentation (pressure or flow gauges) would be considered applicable. Inspection of the treatment zone prior to operation would be considered appropriate. Additionally, plume monitoring for changes to opacity and color during treatment is considered an applicable requirement. Maintenance of inspection or operating logs would not be considered ARARs because these RCRA standards are administrative in nature.

Three operating requirements are established for thermal treatment (40 CFR 265.370 et seq). These include; (1) maintenance of steady state conditions during the treatment event, (2) location of the thermal treatment activity at a minimum distance from other properties, and (3) operation in a manner that protects human health and the environment. The requirement for steady state operation may be waived for batch operations such as the flashing activities that will be conducted at AAAP. Separation distance requirements are based upon the mass of explosive material per treatment event. These requirements are inherently met by the flashing activities at AAAP. However, a separation distance equal to the minimum value specified in 40 CFR 265.382 (670 ft) is usually maintained between the open burning/open detonation (OB/OD) treatment zone and any other structure. Operation in a manner to protect human health and the environment is subsequently discussed in conjunction with general environmental performance standards for miscellaneous units. The waivers from steady state performance and distance standards are considered to be applicable requirements.

Althouth permits are not required for on-site remedial actions at NPL sites, the substantive standards related to the specific activity may formulate ARARs. Permit standards for miscellaneous units, including thermal treatment, are codified in 40 CFR 264, Subpart X. These standards require location design, operation, and closure of the unit in a manner that is protective of human health and the environment. Unlike other RCRA units where the general performance objectives are achieved by specified design standards, only generalized environmental performance standards are applied to miscellaneous units. The general environmental performance

standards require that the owner demonstrate prevention of releases to air, surface waters, or subsurface media that could have adverse effects on human health and the environment. In demonstrating compliance with these standards, the operator must consider both waste and media characteristics. For example, the demonstration for subsurface media must consider waste characteristics, the units hydrogeologic characteristics, ground water quality and use, relative location of groundwater withdrawal wells, and risks to plant, animal or human receptors. Eleven similar factors must be considered to demonstrate compliance with the surface water performance standard. Factors for the air performance standard include waste characteristics, plume characteristics, reliability of the proposed treatment, atmospheric conditions, and the existing air quality.

The Endangerment Assessment (EA) performed in conjunction with the RI/FS generally meets the requirements of the Subpart X general environmental performance standards. However, compliance with this ARAR would require tailoring the EA to the flashing activity. Additionally, air emission factors would need to be considered to demonstrate compliance with that performance standard. Demonstration that this standard is met is usually achieved by instantaneous plume dispersion modeling such as the PUFF or INPUFF models. During detonation, the majority of energetic materials are converted to N_2, H_2O, and CO_2. For example, alkyl nitrates, such as nitroglycerin, yield <0.15 lb of CO/lb of energetic material with the remainder converted to N_2, H_2O, and CO_2. Aryl nitrates, such as TNT or tetryl, release some NO_x during combustion. For example, during burning of TNT, ~0.06 lb of CO and ~0.16 lb of NO_x are emitted. This type of mass balance data is generally input to the gaussion dispersion models to compare predicted airborne concentrations with National Ambient Air Quality Standards (NAAQS) at downwind locations. Thus, compliance with this performance standard will satisfy ARARs that are derived from both RCRA and the Clean Air Act (CAA).

Additional permit conditions that are generally applied to miscellaneous units are requirements to meet the general waste analysis, security, inspection, personnel training, and preparedness/prevention standards of 40 CFR 264, Subparts B and C. Waste analysis requirements include development of sampling procedures, frequencies, and analytical protocols for the parameters previously described. Security requirements include posting and the use of barriers to prevent unauthorized entry. Inspection and maintenance of emergency response equipment, operating equipment, and monitoring equipment are required by both 40 CFR 264.15 and 40 CFR 264.33. In particular, fire control equipment will need to be properly maintained and on hand during flashing operations.

Maintenance of spill control equipment, alarms, or aisle space would not be considered as ARARs because these items are not inherent to the flashing operations. Personnel training requirements for remedial activities are mandated by Occupational Safety and Health Administration (OHSA) standard 1910.120. It is recommended that personnel involved directly with flashing operations be provided additional specialized training in the use of the operating equipment specific to the activity and the unique hazards of the work. Although the documentation required

by many of the general facility standards (i.e., operation logs, inspection logs etc.) are administrative and, therefore, not ARARs, the conduct of these activities is considered relevant and appropriate. The remaining general facility standards of 40 CFR 270 (i.e., spill prevention procedures, procedures for loss of utilities, actions in the event of water supply contamination) bear no relation to the activity and, therefore, are not considered ARARs.

Upon termination of their active life, thermal treatment units must close by decontamination of equipment and facilities, removal of the waste, removal of residuals, and certification of closure. Although completion of the initial decontamination might be considered to correspond to closure, the activity is a part of a total remedial action, that upon completion, is intended to attain levels of control that are protective of human health and the environment. Thus, it is considered probable that closure requirements could be waived as ARARs. Under this provision (CERCLA § 121) the operational based requirements might also be waived, but their removal as ARARs is considered less likely.

The other activity that will be performed as part of the initial decontamination activity is removal of rubble piles that contain friable asbestos. The potential ARARs for this activity are the National Emissions Standards for Hazardous Air Pollutants (NESHAPs) derived from the CAA and certain OSHA requirements. It is considered possible that the de minimis emission rate of 14 lb/year will be exceeded by removal actions. Thus, the asbestos must be maintained in a thoroughly wet condition during removal. Removed material must be double bagged and these packages must be properly labeled in accordance with OSHA requirements. Although the bag type is not specified, the recommended disposal bag is constructed of 6-mil polyethylene. No sharp objects should be placed in the bags and all excess air should be removed. The bagged material should be loaded in fiberboard drums that are also labeled per OSHA requirements. The waste material should be transported for disposal in a dedicated cell in an approved solid waste landfill and covered with 6 in. of compacted soil on a daily basis. No visible emissions are allowed during removal, collection, or disposal.

Additionally, airborne concentrations must be monitored during removal actions to ensure compliance with OSHA standards, NESHAPS, and Alabama Air Toxics Limits. The Permissible Exposure Limit (PEL) for asbestos is 0.2 fibers/cm^3. State air standards are normally based on the Threshold Limit Value (TLV) of <2 fibers/cm^3.

ARARs applicable to the initial decontamination actions are summarized in Table 4.

2.3.2 Off-Site Alternatives

Two off-site alternatives were considered in the RI/FS. Both alternatives involve excavation of soil and sediments for off-site management and extraction of groundwater for treatment at an off-site

Table 4. Action-specific potential ARARs for Alabama Army Ammunition Plant
Alternative 1: Off-site alternatives

Actions	Requirements	Prerequisites	Criteria
On-site construction	Surface water control	Nonpoint source contribution to nonattainment of Ambient Water Quality Standards	Water Quality Act § 316
	Airborne particulate controls	Total suspended particulates (TSP) must be maintained below National Ambient Air Quality Standards for construction	40 CFR 50.4
	Units located in 100-year floodplain must develop methods to prevent washout during a 100-year flood	RCRA[b] unit located within 100-year floodplain	40 CFR 270.14 40 CFR 264.18
Excavation	Area from which materials are excavated may require cleanup to levels established by closure requirements.		See Closure in this Table.
	Movement of excavated materials to new location and placement in or on land will trigger land disposal restrictions for the excavated waste or closure requirements for the unit in which the waste is placed.	Materials containing RCRA hazardous waste subject to land disposal restrictions are placed in another unit	40 CFR 268 (Subpart D)

Table 4. Continued

Actions	Requirements	Prerequisites	Criteria
Transportation	Package and prepare manifest meeting Department of Transportation regulations.	A generator who transports or offers for transportation hazardous waste.	49 CFR 175 49 CFR 178 49 CFR 179
	Standards for labeling, marking placarding, manifest and pre-transport requirements.		40 CFR 262 40 CFR 172
Container storage (on-site)	Containers of RCRA hazardous waste must be: • maintained in good condition, • compatible with hazardous waste to be stored, and • closed during storage (except to add or remove waste).	RCRA hazardous waste (listed or characteristic) held for a temporary period before treatment, disposal, or storage elsewhere, in container (i.e., any portable device in which a material is stored, transported, disposed of, or handled).	40 CFR 264.171 40 CFR 264.172 40 CFR 264.173
	Inspect storage areas weekly for deterioration.		40 CFR 264.174
	A base must underly the containers which is free of cracks or gaps and is sufficiently impervious to contain leaks, spills, and accumulated precipitation until the collected material is detected and removed.	Storage of hazardous waste in containers	40 CFR 264.175 (b)(1)

Table 4. Continued

Actions	Requirements	Prerequisites	Criteria
Container storage (on-site) (continued)	The base must be sloped or the containment system must be otherwise designed and operated to drain and remove liquids resulting from leaks, spills, or precipitation, unless the containers are elevated or are otherwise protected from contact with accumulation liquids.	Storage of hazardous waste in containers	40 CFR 264.175 (b)(2)
	The containment system must have sufficient capacity to contain 10% of the volume of containers or the volume of the largest container, whichever is greater.	Storage of hazardous waste in containers	40 CFR 264.175 (b)(3)
	Runon into the containment system must be prevented unless the collection system has sufficient excess capacity in addition to that required in the above paragraph of this section to contain any runon which might enter the system.	Storage of hazardous waste in containers	40 CFR 264.175 (b)(4)
	Spilled or leaked waste and accumulated precipitation must be removed from the sump or collection	Storage of hazardous waste in containers	40 CFR 264.175 (b)(5)

Table 4. Continued

Actions	Requirements	Prerequisites	Criteria
Container storage (on-site) (continued)	area in as timely a manner as is necessary to prevent overflow of the collection system.		
Container closure	At closure, all hazardous waste and hazardous waste residues must be removed from the containment system. Remaining containers, liners, bases, and soil containing or contaminated with hazardous waste or hazardous waste residues must be decontaminated or removed.	Storage of hazardous waste in containers	40 CFR 264.178
Tank storage (on-site)	Tanks must have sufficient structural strength to ensure that they do not collapse, rupture, or fail.	Storage of RCRA hazardous waste (listed or characteristic) not meeting small quantity generator criteria held for a temporary period greater than 90 days	40 CFR 264.190
	Waste must not be incompatible with the tank material unless the tank is protected by a liner or by other means.	before treatment, disposal, or storage elsewhere (40 CFR 264.10), in a tank (i.e., any portable device in which a material is stored, transported, disposed of, or handled). A generator who accumulates or stores hazardous	40 CFR 264.191
	Tanks must be provided with secondary containment and controls to prevent overfilling, and		40 CFR 264.193-194

Table 4. Continued

Actions	Requirements	Prerequisites	Criteria
Tank storage (on-site) (continued)	sufficient freeboard maintained in open tanks to prevent overtopping by wave action or precipitation.	waste on-site for 90 days or less in compliance with 40 CFR 262.34(a)(1-4) is not subject to full RCRA storage requirements. Small quantity generators are not subject to the 90-day limit [40 CFR 262.34 (c), (d), and (3)].	
	Inspect the following: overfilling control, control equipment, monitoring data, waste level (for uncovered tanks), tank conditions, above-ground portions of tanks (to assess their structural integrity), and the area surrounding the tank (to identify signs of leackage).		40 CFR 264.195
	Repair any corrosion, crack or leak.		40 CFR 264.196
	Store ignitable and reactive waste so as to prevent the waste from igniting or reacting. Ignitable or reacting waste in covered tanks must comply with buffer zone requirements in "Flammable and Combustible Liquids Code," Tables 2-1 through 2-6 (National Fire Protection Association, 1976 or 1981).		40 CFR 264.198

Table 4. Continued

Actions	Requirements	Prerequisites	Criteria
Tank closure	The owner or operator must close the facility in a manner that minimizes the need for further maintenance and control, minimize, or eliminate to the extent necessary to protect human health and the environment, postclosure escape of hazardous waste, hazardous constituents, leachate, contaminated runoff, or hazardous waste decomposition products to the ground or surface waters to the atmosphere.	Use of tank systems for storing or treating RCRA hazardous waste	40 CFR 265.111
	At closure, remove all hazardous waste and hazardous waste residues from tanks, discharge control equipment, and discharge confinement structure, and manage as a hazardous waste.		40 CFR 264.197
Waste pile	Use a single liner and leachate collection system.	RCRA hazardous waste, noncontainerized accumulation of solid nonflammable hazardous waste that is used for treatment of storage	40 CFR 264.251

Table 4. Continued

Actions	Requirements	Prerequisites	Criteria
Waste pile (continued)	Double liner requirements and leach detection systems.	Proposed rule; not yet ARAR	52 FR 20218 (May 29, 1987) Final rule expected 9/92
	Amendments to waste pile closure regulations.	Proposed standards; not yet ARAR	52 FR 8712 (March 19, 1987) Reproposed NPRM[c] on hold; guidelines expected to appear instead
	Waste put into waste pile is subject to land ban regulations (40 CFR 268).		
Off-site landfill	Corrective action for solid waste management units.	Treatment, storage, or disposal of hazardous waste.	40 CFR 264.101
Off-site landfill (treatment when waste will be land-disposed)	Treatment of waste subject to ban on land disposal must attain levels achievable by best demonstrated available treatment technologies (BDAT) for each hazardous constituent in each listed waste, if residual is to be land disposed. If residual is to be further treated, initial treatment and any subsequent treatment that produced residual	The following wastes have been prohibited from land disposal without treatment:	40 CFR 268 (Part D)
		• Spent solvent and dioxin-containing waste	51 FR 40572 (Nov. 7, 1986)
		• "California list" waste	52 FR 25760 (July 8, 1987)
		All ranked and listed haz-	

Table 4. Continued

Actions	Requirements	Prerequisites	Criteria
Off-site landfill (treatment when waste will be land-disposed) (continued)	to be treated need not be BDAT, if it does not exceed value in constutient in a waste extract (CCWE) table for each applicable water (see 51 FR 40642, November 7, 1986).	ardous wastes identified in 40 CFR Part 261: • First third • Second third • Final third	53 FR 31138 (August 17, 1988) 54 FR 26594 (June 23, 1989) 54 FR 48372 (Nov. 22, 1989)
	No-migration variance for restricted hazardous waste land disposal.	Proposed ARAR. Land disposal of untreated hazardous waste that has been restricted from land disposal	40 CFR 268 (Part D) NPRM 3/90; Final rule expected 11/91
	Treatment and disposal of hazardous soil and debris.	Proposed ARAR. Separate treatment standards for contaminated soil and debris.	40 CFR 268 (Part D) NPRM 12/90; Final rule expected 10/91
Off-site incineration	Corrective action for solid waste management units.	Treatment, storage, or disposal of hazardous waste.	40 CFR 264.101
Closure with no post-closure care (e.g., clean closure)	Removal or decontamination of all waste residues, structures and equipment contaminated with waste and leachate, and management of them as hazardous waste.	May apply to surface impoundments and container or tank liners and hazardous waste residues, and to contaminated soil, including soil from dredging or soil disturbed in	40 CFR 264.111 40 CFR 264.178 40 CFR 264.197 40 CFR 288(0)(1) and 40 CFR 264.258

Table 4. Continued

Actions	Requirements	Prerequisites	Criteria
Closure with no post-closure care (e.g., clean closure)		the course of drilling or excavation, and returned to land.	
	Meet health-based levels at unit. General performance standard requires elimination of need for further maintenance and control; elimination of post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated runoff, or hazardous waste decomposition products.	Applicable to land-based unit containing hazardous waste. Designed for cleanup that will not require long-term management. Designed for cleanup to health based standards.	40 CFR 264.111(b) 40 CFR 264.111
	Disposal or decontamination of equipment, structures, and soils.		40 CFR 264.111 40 CFR 264.178 40 CFR 264.197 40 CFR 264.288 (o)(1)
	At closure, the following must be performed: • Remove or decontaminate all waste residues, contaminated containment system components, contaminated subsoils, structures, and equipment contaminated with waste and leachate, and manage them as hazardous waste.		40 CFR 264.310

Table 4. Continued

Actions	Requirements	Prerequisites	Criteria
Closure with no post-closure care (continued)	• Eliminate free liquids by removing liquid wastes or solidifying the remaining wastes and waste residues. • Stabilize the remaining wastes so that they have a bearing capacity capable of supporting the final cover, and cover the surface impoundment with a final cover designed and constructed to: - provide long-term minimization of liquids through the impoundment, - function with minimum maintenance, - promote drainage and minimize erosion or abrasion of the final cover, - accommodate settling and subsistence so that the cover's integrity is maintained, and - have a permeability that is less than equal to the permeability of any bottom liner system or natural subsoils present.		

Table 4. Continued

Actions	Requirements	Prerequisites	Criteria
Discharge to publicly owned treatment works (POTW)	Discharge of pollutants that pass through the POTW without treatment, interfere with POTW operations, contaminate POTW sludge, or endanger health/safety of POTW workers, is prohibited.	Indirect discharge to a POTW.	40 CFR 403.5
	Specific prohibitions preclude the discharge of pollutants to POTWs that: • create a fire or explosion hazard in the POTW; • will cause corrosive structural change to POTW; • obstruct flow resulting in interference; • are discharged at a flow rate and/or concentration that will result in interference; • increase the temperature of wastewater entering the treatment plant that would result in interference, but in		40 CFR 403.5(b)

Table 4. Continued

Actions	Requirements	Prerequisites	Criteria
Discharge to POTW (continued)	no case raises the POTW influent temperature, above 104°F (40°C);		
	• discharge must comply with local POTW pretreatment program, including POTW-specific pollutants, spill prevention program requirements, and reporting and monitoring requirements.		40 CFR 403.5 40 CFR 403.8
	• compliance with RCRA permit-by-rule requirements (including corrective action where the NPDES permit was issued after November 8, 1984) for discharges of RCRA hazardous wastes to POTWs.	Transport of RCRA hazardous wastes to POTWs by truck, rail, or dedicated pipe (i.e., pipe, solely dedicated for hazardous waste (as defined in 40 CFR 264), which discharges from within the boundaries of of the CERCLA site to within the boundaries of the POTW. RCRA hazardous waste placed at site after the effective date of the requirements.	40 CFR 270.60

[a]ARAR - applicable or relevant and appropriate requirement.
[b]RCRA - Resource Conservation and Recovery Act.
[c]NPRM - Notice of Proposed Rulemaking.

Publicly Owned Treatment Works (POTW). In both alternatives, soils and sediments will be excavated to meet the soil cleanup levels listed in Table 2. After excavation, in Alternative 1A, the soils would be transported to a RCRA-permitted landfill for disposal. In this alternative, groundwater would be extracted and transported for treatment at an off-site POTW. The second off-site alternative (Alternative 1B) differs from the first option only in that the soils and sediments would be incinerated.

The first phase of this remedial action is the excavation of the contaminated soils in Area B. These activities will require the development of surfaces suitable for vehicular traffic. It is known that limited excavation, movement of soils, site grading, and site cleaning activities will be required. As a result of these actions, requirements from two environmental statutes are considered potential ARARs (see "On-site construction", Table 4).

Under § 316 of the Water Quality Act (WQA) of 1987, states are required to provide to EPA an assessment that identifies those bodies of water that do not attain Ambient Water Quality Standards (AWQSs) as a result of nonpoint source pollution. In conjunction with this effort, states must develop and submit to EPA Best Management Plans (BMP) designed to reduce the impact of pollutants from these nonpoint source discharges. Under WQA, the state assessment reports and BMPs were to be submitted to EPA by August 1988.

Surface waters in the vicinity of the construction site will need to be monitored to identify potential impacts from this nonpoint source (construction) activity. The relevant monitoring parameters for such activities generally include total suspended solids (TSS), total dissolved solids (TDS), biochemical oxygen demand (BOD5), and color. Additionally, construction of control devices such as runon diversion trenches, berms, and/or settling basins should be considered to reduce impacts from site-related activities. Such activities would be considered applicable only if the state identified the receiving stream as not in compliance with AWQSs due to nonpoint source pollution. However, such requirements are relevant and appropriate because the affected media, pollutants of concern, activities, and objectives within Sect. 316 of the WQA and those related to this stage of the remedial action are sufficiently similar.

Airborne pollutants will also result from these construction activities. The primary concern is elevation of particulate concentrations resulting from earth-moving and site-grading activities. Monitoring for particulate levels during site construction activities is generally required for any large-scale construction operation. Thus, this monitoring standard is considered relevant and appropriate due to its general application. The particulate concentrations are determined by placing PM-10 samplers at the property boundaries. The NAAQSs for particulates are 50 $\mu g/m^3$ per arrival and 150 $\mu g/m^3$ per 24-hour period. AAAP is responsible for meeting these standards, although such standards are rarely enforced. Generally, procedures for control, such as spraying down roads for dust suppression, will be sufficient to meet the standards

during the construction phase.

The next procedure in this action is transporting the soils off-site for treatment (see "Transportation", Table 4). Removal of the RCRA-listed wastes (soils and sediments) from the Aniline Sludge Basin, Red Water Storage Basin, Red Water Ditch or Spoil Banks is considered new generation of hazardous wastes. Other soils or sediments that are excavated will not be hazardous waste unless these are characteristically hazardous by reactivity. Any generator that transports or offers for transportation, hazardous waste for off-site treatment, storage or disposal, must prepare a manifest. The waste must be packaged in accordance with Department of Transportation (DOT) regulations codified in 49 CFR Parts 175, 178, and 179 (see Table 4). These requirements are considered ARARs for the hazardous waste soils as AAAP meets the prerequisites as a generator of a hazardous waste. In addition to the manifest and pretransport requirements detailed in Subparts B and C of 40 CFR 262, standards for labeling, marking, and placarding that are stated in 49 CFR Part 172 must be met.

Under 40 CFR 262.34, generators may accumulate waste on-site for up to 90 days in a nonpermitted storage facility. Although direct loading to transport vehicles is possible, it is considered probable that accumulation or storage of the waste may be required. Accumulation areas must comply with the interim standards of 40 CFR 265, Subparts C, D, and I. These standards are similar to those found in 40 CFR 264, but the latter are more stringent, and thus are listed in Table 4. Accumulation areas must maintain alarm or communication systems, emergency response equipment, spill control equipment, and decontamination equipment. Sufficient aisle space for operations, inspections, and emergency response must be provided. Standards codified in 40 CFR 265, Subpart D require development of a contingency plan that establishes an emergency response coordinator, identifies response equipment, and establishes response procedures. The equipment, aisle space, and inspection requirements from 40 CFR 265, Subpart C, are considered ARARs because these are design and operating standards. Contingency plans are administrative requirements that would not normally be considered ARARs but were retained because such documents are usually prepared as a matter of course for remedial activities.

Interim accumulation of RCRA-listed wastes in containers or tanks invokes requirements of 40 CFR 265, Subpart I or J, respectively. If accumulation is performed in containers (see "Container storage, on-site", Table 4), the primary requirements include the following:

- containers must be compatible with the waste,
- incompatible waste must be segregated and may not be placed in the same container,
- containers must be in good condition and managed to prevent spill or rupture,
- containers must remain closed except for placement or removal of waste,
- containers must be properly marked and labeled, and
- containers must be inspected weekly.

Accumulation tanks must meet requirements of 40 CFR 265, Subpart J (see "Tank storage", Table 4). New tank systems must be designed to ensure structural integrity and prevent corrosive attack. Prior to use, tank system components must be visually inspected for defects, the installation must be certified and the system must be leak tested by a volumetric or nonvolumetric technique. Accumulation tanks must be provided with secondary containment equal to 100% of the volume of the largest tank within its boundary and be fitted with interstitial monitoring. Secondary containment provisions may be waived on the basis of alternate design, location, operating, and waste characteristics. Such a waiver would be considered likely if a covered top tank were used for accumulation of soils. Additional tank system requirements include daily inspection of all externally accessible portions of the tank system. The container and tank accumulation requirements are considered ARARs. Upon closure of the accumulation area, the general interim status closure performance standard of 40 CFR 265.111 must be met (see "Tank closure", Table 4).

If the soils are stored on-site for longer periods of time, certain additional standards become applicable. Facilities that store RCRA-listed waste in containers or tanks must comply with 40 CFR 264, Subparts B, C, D, E, G, and H. Requirements pursuant to Subparts E and H are administrative and are not considered ARARs. The preparedness and contingency plan requirements of Subparts C and D do not differ substantially from those previously discussed. Thus, the primary additional requirements derive from the 40 CFR 264, Subpart B, General Facility Standards.

Under the General Facility Standards (40 CFR 264.10 et seq.), container storage facilities are required to develop and maintain waste analysis plans, site security procedures, site inspection schedules, and provide personnel training. Although the documentation required by these standards is administrative in nature and, therefore, not ARARs, the conduct of these activities is relevant and appropriate.

The primary additional container storage facility requirements under 40 CFR 264, Subpart I include runon and runoff controls, an impermeable crack-free base that is sloped to minimize contact with free-standing liquids, and a containment system sized to contain 10% of the stored volume. These standards are detailed under "Container storage" in Table 4. Container closure standards (Table 4) appear in 40 CFR 264.178.

As an alternative storage system, a waste pile may be used for the staging operations (see "Waste piles", Table 4). Design and operating requirements are found in 40 CFR 264.251. Waste piles must be constructed with a single liner and leachate collection system above the liner. The liner and leachate collection system must be compatible with the waste constituents and must have sufficient strength to withstand operational stress, static pressure and climatic conditions. In addition to the liner/leachate collection system, waste piles must be provided with a runon control system designed for a 25-year, 24-hour flood event and provided with groundwater monitoring. During operation, the pile, control

systems, and leachate collection system must be inspected weekly. The liner system must be inspected during and after construction.

The liner/leachate and groundwater monitoring provisions may be waived if the design is an engineered structure that controls entry of runon and precipitation, provides inner and out layers of containment, and stores no free liquids. This design is most readily accomplished by a base that consists of compacted clay, a drainage bed, and an FML that is surrounded by berms or walls and provided with a roof.

For alternative 1A, the landfill to which AAAP transports the hazardous waste must meet the minimum requirements of 40 CFR 264. The facility in Emelle, Alabama where AAAP plans to ship the waste meets these standards. Additionally, under Sect. 121(d)(3) of CERCLA, off-site disposal facilities must be in compliance with requirements established pursuant to RCRA 3004(u), 3004(v), or 3008(h).

The land disposal requirements from 40 CFR 268 will pertain to certain wastes removed from AAAP (see "Off-site landfill", Table 4). Soils and sediments from the Red Water Storage Area (Area 5) and Red Water Ditch (Area 2) meet the 40 CFR 261.32 listings K044 and K047. Under the "first third" land disposal restrictions the treatment standard for these wastes is no disposal. Thus, these soils/sediments must be thermally treated and delisted prior to land disposal. 40 CFR 264.600 addresses thermal treatment units.

Soils and residues removed from the Aniline Sludge Basin (Study Area 9) are suspected of meeting the 40 CFR 261.32 listings of K083, K103, and/or K104. Land disposal restrictions for these wastes are codified in 40 CFR 268.43 and are specified as the Constituent Concentrations in Waste (CCW) for K103 and K104. The Best Demonstrated Available Technology (BDAT) for K083 is no disposal. Thus, if the K083 listing is appropriate, these soils must be incinerated or thermally treated and delisted prior to disposal. If the K103 and K014 listings apply, the soils must be treated to below the 40 CFR 268.43 CCW limits prior to land disposal. The CCWs for K103 and K104 nonwastewaters presented below would be the applicable land disposal restriction criteria.

Contaminant	Concentration (ppm)
Aniline	5.6
Benzene	6.0
2,4-Dinitrophenol	5.6
Nitrobenzene	5.6
Phenol	5.6
Cyanides	1.8

Alternative 1B differs from Alternative 1A in that the soils and sediments will be incinerated off-site (see "Off-site incineration", Table 4). All of the construction or transportation and storage standards discussed for Alternative 1A and appearing in Table 4 continue to apply

for the incineration alternative. Also applicable are CERCLA-based standards for off-site treatment units in compliance with RCRA 3004(u).

The off-site incineration alternative offers the advantage that thermal treatment followed by delisting is required for certain 40 CFR 268 restricted wastes. Additionally, incineration is likely to achieve the CCW limits for other restricted wastes derived from AAAP. Incineration ARARs are discussed in conjunction with the on-site incineration alternative in Sect. 2.3.4.

The final phase of this remedial action alternative involves the treatment of the extracted groundwater by a POTW. At present, there are no ARARs applicable to the extraction wells. However, certain standards must be achieved before the POTW can treat the groundwater. Discharge to a POTW (see Table 4) is considered an off-site activity. Off-site actions must comply with all legally applicable requirements including permit and administrative conditions.

The National Pretreatment Program, authorized under CWA §307(b), controls the indirect discharge of pollutants to POTWs. For the effluent to be acceptable to the POTW for treatment, the discharge of pollutants in the effluent that pass through the POTW without treatment, interfere with POTW operation, contaminate POTW sludge, or endanger health/safety of POTW workers, is prohibited.

In addition to the general prohibition on discharges that pass through or interfere, 40 CFR 403.5 establishes specific prohibitions that preclude certain discharges to POTWs. These specific prohibitions are provided in Table 4. Enforcement of the specific prohibitions varies among municipalities. The discharge must also comply with local POTW pretreatment programs, including POTW-specific pollutants, permit requirements, and monitoring requirements (40 CFR 403.8).

RCRA permit-by-rule requirements are triggered if the POTW receives hazardous wastes by truck, rail, or dedicated pipe (40 CFR 270.60). The widely dispersed contamination at AAAP precludes any determination that contaminated groundwater derives directly from treatment, storage, or disposal of listed wastes. If the wastewaters are determined to be hazardous waste, then the prerequisite is met and the permit-by-rule regulations are deemed applicable. In summary, these include compliance with their NPDES permit, RCRA notification requirements, the manifest system, and reporting requirements. The influent must meet all federal, state, and local pretreatment standards. If the POTW is operating under an NPDES permit issued after November 8, 1984, including renewed permits, the POTW must also comply with the corrective action requirements under RCRA 3004(u).

2.3.3 On-Site Landfill/Groundwater Treatment Alternative

The on-site landfill alternative involves excavation of soils/sediments contaminated with explosives and lead to achieve soil cleanup levels and placement of these residues in an on-site landfill. Table 5

Table 5. Action-specific Potential ARARs[a] for Alabama Army Ammunition Plant Alternative 2. On-site Landfill/groundwater Treatment

Actions	Requirements	Prerequisites	Criteria
On-site construction	See Table 4	See Table 4	See Table 4
Excavation	See Table 4	See Table 4	See Table 4
Construction of new landfill on-site	Minimum Technology Requirements:		40 CFR 264.301
	Install two liners or more, a top liner that prevents waste migration through the liner.	RCRA[b] hazardous waste (listed or characteristic) currently being placed in a new, replacement, or expanded landfill.	
	Install leachate collection systems above and between the liners.		40 CFR 264.301
	Construct runon and runoff control systems capable of handling the peak discharge of a 25-year storm.		40 CFR 264.301
	Control wind dispersal of particulates.		40 CFR 264.301
	Operation and maintenance.		40 CFR 264.303-304
	Close each cell with a final cover after the last waste has been received.		40 CFR 264.310

Table 5. Continued

Actions	Requirements	Prerequisites	Criteria
Construction of new landfill on-site (continued)	Groundwater monitoring:		
	Establish a detection monitoring program (264.98). Establish a compliance monitoring program (264.99) and corrective action monitoring program (264.100) when required by 40 CFR 264.91. All monitoring programs must meet RCRA general groundwater monitoring requirements (264.97).	Creation of a new landfill unit to treat, store, or dispose of RCRA hazardous wastes as part of a response action.	40 CFR 264.91-264.100
Placement of liquid waste in landfill	Liquids in landfills prohibition:		
	No bulk or noncontainerized liquid hazardous waste or hazardous waste containing free liquids may be disposed of in landfills.	Placement of bulk or noncontainerized RCRA hazardous waste in a landfill.	40 CFR 264.314
	Containers holding free liquids may not be placed in a landfill unless the liquid is mixed with an absorbent or solidified.		40 CFR 264.314
Placement of waste in land disposal unit	Land disposal restrictions:		
	Attain land disposal "treatment standards" before putting waste into landfill in order to comply	Placement of RCRA hazardous waste in a landfill, surface impoundment, waste pile,	40 CFR 268 (D)

Table 5. Continued

Actions	Requirements	Prerequisites	Criteria
Placement of waste in land disposal unit (continued)	with land ban restrictions. A treatment standard can be either (1) a concentration level to be achieved (performance based) or (2) a specified technology that must be used (technology based). If the standard is performance based, any technology can be used to achieve the standard (see treatment when waste will be land disposed).	injection well, land treatment facility, salt dome formation, or underground mine or cave.	
Waste pile	See Table 4	See Table 4	See Table 4
Closure with waste in place	Eliminate free liquids by removal or solidification.	Applicable to land disposal of hazardous waste. Applicable to RCRA hazardous waste (listed or characteristic) placed at site after the effective date of the requirements, or placed into another unit.	40 CFR 264.228(a)(2)
	Stabilization of remaining waste and waste residues to support.		40 CFR 264.228(a)(2)
	Installation of final cover to provide long-term minimization of infiltration (see Capping, Table 7).		40 CFR 264.310
	30-year postclosure care and groundwater monitoring.		40 CFR 264.310

Table 5. Continued

Actions	Requirements	Prerequisites	Criteria
Treatment unit	Design and operating standards for unit which hazardous waste is treated (see citations at right for design and operating requirements for specific unit).	Treatment of hazardous waste in a unit.	40 CFR 264.190 to 264.192 (tanks) 40 CFR 264.221 (surface impoundments) 40 CFR 264.251 (waste piles) 40 CFR 264.273 (land treatment unit) 40 CFR 264.343-.345 (incinerators) 40 CFR 264.601 (miscellaneous treatment units) 40 CFR 265.373 (thermal treatment units)
Tank storage (on-site)	See Table 4	See Table 4	See Table 4
Container storage	See Table 4	See Table 4	See Table 4
Container closure	See Table 4	See Table 4	See Table 4
Tank closure	See Table 4	See Table 4	See Table 4

Table 5. Continued

Actions	Requirements	Prerequisites	Criteria
Underground injection of wastes and treated groundwater	Underground Injection Control (UIC) program prohibits: • injection activities that allow movement of contaminants into underground sources of drinking water which may result in violations of maximum contaminant level (MCLs) or adversely affects health; and • construction of new Class IV wells, and operation and maintenance of existing wells. Class IV wells are banned except for reinjection of treated groundwater into the same formation from which it was withdrawn as part of a CERCLA cleanup or RCRA corrective action.	Approved UIC program is required in states listed under Safe Drinking Water Act (SDWA) section 1422 (all states have been listed). Class I wells and Class IV wells are the relevant classifications for CERCLA sites. Class I wells are used to inject hazardous waste, beneath the lowermost formation containing, within one quarter mile, underground source of drinking water (USDW). Class IV wells are used to inject hazardous or radioactive waste into or above a formation which contains, within one quarter mile of the well, an underground source of drinking water.	40 CFR 144.12 40 CFR 144.13(c)

[a]ARAR = applicable or relevant and appropriate requirement.
[b]RCRA = Resource Conservation and Recovery Act.

lists the ARARs for this alternative. Soils/sediments contaminated only with lead will be removed from Area B, and depending on the EP Toxicity tests, may be placed in an on-site sanitary landfill. Contaminated groundwater will be extracted from Area B and treated on-site using carbon adsorption. The treated effluent will then be reinjected, upgradient of the extraction well network, and the spent carbon will be deposited in the secure landfill.

Prior to construction or operation of the disposal or treatment units required by this alternative, construction activities will be required to stage and place the equipment, establish utilities, provide piping runs, and establish work zones for the purpose of decontamination, site management, and monitoring. The ARARs for "Excavation" and "On-site construction" were discussed in Sect. 2.3.2 and are listed in Table 4.

Contaminated soils will be placed into the landfill constructed on-site. A portion of the soils to be landfilled are considered listed hazardous waste (K044, K047, K083, K103). Other soils contain several 40 CFR 261, App. VIII, hazardous constituents, such as DNT, nitrobenzene, or lead, although these soils do not appear to be characteristically hazardous. Removal of the listed soils and placement in the new secure landfill constitutes generation and disposal. Thus, a jurisdictional prerequisite is established that requires the landfill to meet RCRA standards for design, operation, maintenance and closure phases. These standards are detailed in 40 CFR 264, Subparts F, G, and N, and are considered ARARs for this action.

The Hazardous and Solid Waste Amendments (HSWA) established minimum technological requirements for new landfills (40 CFR 264.300 et seq.; see "Construction of new landfill on-site", Table 5), including the use of two or more liners and a leachate collection system above and between the liners to detect any leaks. An intensive quality assurance (QA) program is required to ensure proper construction of the synthetic liner. Standard engineering practice requires removal of a statistical number of samples of the welds for destructive inspection to ensure their integrity.

The leachate collection systems must be fed to a central collection sump and leachate treatment system. Inspection of the leachate collection system for the presence of free liquids and treatment of collected leachate will be required in both the active life and postclosure period. To prevent damage to the landfill, a runon and runoff control system to manage the water volume resulting from a 24-hour, 25-year flood event must be constructed and maintained (40 CFR 264.301).

During construction and operation, inspections for particulate matter, imperfections in the liner, improper operation of runon and runoff controls, ponding, liquids in the leachate collection system, and the structural integrity of the berms is required (40 CFR 264.303). In addition, berms must be constructed so that structural integrity is ensured by a slope of <30° and proper compaction during construction. The inspections are required weekly and after storm events.

During operation, all ignitable or reactive waste must be rendered noncharacteristic prior to placement in the landfill. Under the HSWA provisions, bulk hazardous or nonhazardous free liquids may not be placed in the unit (see "Placement of liquid waste in landfill", Table 5). Containerized waste must not have free-standing liquids upon disposal. Thus, it is possible that certain soils will require addition of silicate solidification agents prior to disposal. As previously described, soils from Areas 5, 9, and 21 must meet the pretreatment standards prior to disposal. For those soils from Areas 5 and 21 the 40 CFR 268 restriction criteria is a "no disposal" standard and, therefore, these soils must be thermally treated and delisted prior to disposal (see "Placement of waste in land disposal unit", Table 5).

The general groundwater monitoring requirements found in 40 CFR 264.91-100 will apply. A minimum of one upgradient and three downgradient wells are required for the detection monitoring program specified by HSWA for new land disposal units. These wells should be located in the shallow low-yielding aquifer with the upgradient well positioned to be unaffected by the unit and the downgradient wells located at the waste management boundary. The aquifer must be sampled for depth, direction, and flow on an annual basis. During the first year of operation, a data base of background values for the National Interim Primary Drinking Water Standards and other pertinent indicator parameters must be established from the upgradient wells. The other indicator parameters generally include total organic carbon, total organic halides, pH, specific conductance, and any 40 CFR 264, App. IX indicator chemical that may be reasonably derived from the facility.

Upon closure of the landfill (see "Closure with waste in place", Table 5), postclosure care must be provided for a minimum of 30 years. The landfill must be capped by a clay and FML cap less permeable than the bottom liners. Long-term maintenance must be provided for the runon diversion system, cover system, cap, groundwater monitoring system, leachate collection system, and leachate treatment system. Long-term monitoring of the waste containment system must also be provided (see "Capping", Table 7).

The next action will be the treatment of the groundwater in the carbon adsorption system. The standards that are potential ARARs for the treatment system are indicated under "Treatment unit" in Table 5. The standards typically applied to treatment systems are those for tank systems found in 40 CFR 264.190 et seq. (see "Tank storage", Table 4). Under 40 CFR 264.192, all new tank systems are required to provide structural integrity, compatibility with the waste, an assessment of the corrosion potential, and the required type of corrosion protection. Additionally prior to use, the tank system must undergo a visual inspection, certification of proper installation, and either a volumetric or nonvolumetric integrity test.

Further design and operating requirements for tank systems are provided in 40 CFR 264.193 through 40 CFR 264.195, including secondary containment, interstitial monitoring, and overflow prevention systems,

such as level controls, bypass systems, process flow controls, and process monitoring equipment. The final operating requirement for tank systems is that all externally accessible portions of the tank, ancillary equipment, and secondary containment must be inspected daily.

These design and operating requirements are applicable to the activated carbon columns, any holding tanks, and ancillary equipment employed in the treatment system if the groundwater contamination is considered to be derived from disposal of hazardous wastes. However, the diverse nature of the contamination at AAAP prevents determination that groundwaters are hazardous waste under the "derived from" rule since contamination may result not only from listed and characteristic waste but also from non-RCRA nitroaromatic contaminated soils. Thus, it is possible that the treatment system would not need to meet the RCRA tank rules.

During operation, spent activated carbon will be generated by the treatment unit. Accumulation or on-site storage of this waste will be required (see "Container storage" and "Tank storage", Table 4). If the spent carbon is considered derived from hazardous waste groundwater and is accumulated for <90 days, the applicable requirements are limited to the standards of 40 CFR 265, Subparts C, D, and I. These standards have been previously discussed in conjunction with accumulation of excavated soils (Section 2.3.2). Upon closure of the accumulation area, the general interim status closure performance standard of 40 CFR 265.11 must be met. If the activated carbon is stored on-site for longer periods of time, certain additional standards become applicable. These standards were previously discussed in Sect. 2.3.2.

Spent filter elements from the filtration component of the treatment system must also be stored or accumulated in accordance with these requirements.

Interim status closure requirements of 40 CFR 265.110 et seq. and the unit-specific closure requirements of 40 CFR 265.178 ("Container storage", Table 4) and 40 CFR 265.197 ("Tank storage", Table 4) are also considered applicable to the treatment system and storage facility. The general closure requirements require preparation of a closure plan that details all standards and procedures for waste removal, mitigation of runon, treatment of runoff, monitoring during closure, and that ensure safe handling. The plan must provide detailed descriptions of the methods used to decontaminate or dispose of contaminated structures, facility equipment, work zones, and equipment used for closure. Finally, the plan must provide a step-by-step procedure and corresponding schedule to achieve the elements of the closure action. The closure requirements of 40 CFR 265.178 for container storage do not exceed the general standards. Closure requirements for tank systems are codified by 40 CFR 265.197. For clean closure, these standards are essentially analogous to those for container storage with the added requirements to decontaminate the tank system and secondary containment, remove contaminated soils, and render the tank unfit for further use if it remains on-site. Decontamination of tank systems is usually accomplished by a combination of solvent rinses and steam cleaning. For tank systems without adequate secondary contain-

ment or that cannot remove all contaminated soils, landfill closure may be required (40 CFR 265.310). As before, the standards of 40 CFR Part 264 are listed on the tables.

The general performance standard for the extraction or injection wells is that their construction and operation not result in the contamination of an underground source of drinking water (40 CFR 144.12). This requirement applies to both Class I and Class IV wells (see "Underground injection of wastes and treated groundwater", Table 5).

After treatment in the carbon adsorption system, the water will be recharged to the groundwater (see "Underground injection of wastes and treated groundwater", Table 5). As defined by 40 CFR 144.6, Class IV wells are wells used by generators of hazardous waste or owners or operators of hazardous waste management facilities to inject hazardous waste into or above a formation containing an underground source of drinking water within one-quarter mile of the well bore. Operation or construction of Class IV wells is prohibited and allowed only for the reinjection of treated groundwaters as part of a CERCLA or RCRA cleanup action (40 CFR 144.13).

Effective August 8, 1988, the "first third" of RCRA listed waste were prohibited from land disposal. As previously indicated, these restricted wastes included K044, K047, K083, K103, and K104. However, land disposal via an injection well was not prohibited as of this effective date. Under 40 CFR 148.14, underground injection of K104 is prohibited as of August 1990 unless the pretreatment standard of 40 CFR 268, Subpart D, is met prior to injection (see "Placement of waste in land disposal unit", Table 5). The standards for nonwastewater K104 were provided in Section 2.3.2. If any of the groundwater contamination could be directly attributed to disposal of K104 in the Study Area, then the groundwater would require treatment prior to reinjection to the K104 wastewater CCW limits indicated below:

- aniline - 4.5 ppm,
- benzene - 0.15 ppm,
- 2,4-dinitrophenol - 0.61 ppm,
- nitrobenzene - 0.073 ppm,
- phenol - 1.4 ppm, and
- cyanides - 2.7 ppm.

2.3.4 On-Site Incineration/Groundwater Treatment Alternative

Under this alternative, soils/sediments contaminated with explosives or explosives and lead will be removed from Area B to meet the soil cleanup criteria listed in Table 2. Soils/sediments contaminated with explosives or explosives and lead will be treated in an on-site incinerator. Soils/sediments contaminated with lead only will be disposed in an on-site RCRA-designed landfill. On-site treatment of groundwater from Area B is the same as described under the preceding alternative, with the exception that the spent carbon will be incinerated or regenerated on-

site.

For this action, the excavation and construction requirements are the same as those discussed in preceding sections and presented in Table 4. Also for those soils that are considered RCRA-listed wastes (Study Areas 5, 9, and 21), the accumulation or storage requirements, the landfill standards, the land disposal restriction, and the pretreatment standards (BDAT) are the same for those in the preceding alternative (Table 5). If contaminated groundwater is considered as derived from RCRA-listed waste, the storage and treatment standards previously discussed are applicable. Incinerator ash from treatment of RCRA-listed soils and possibly spent carbon (if the derived-from criteria applies) must also meet these standards. For other soils and possibly activated carbon, which do not exhibit a hazardous waste characteristic, only sanitary landfill disposal is required (see "Construction of new landfill on-site" and other landfill regulations found in Table 5). However, it is assumed that only a single secure landfill would be constructed for practical reasons. Thus, this alternative differs from prior options only due to incineration activities.

For the incineration alternative, several requirements will have to be met during the installation, operation, and removal of the system. The potential ARARs for this activity derive from the incinerator standards of 40 CFR 264, Subpart O (see Table 6). These standards are considered applicable because the incinerator provides treatment to K044, K047, K083, K103, and K104 wastes.

In general, items such as the temperature, feed rate residence time, and fuel/air ratios are specified and monitored to ensure that a specified destruction and removal efficiency (DRE) is achieved. Operating limits for the waste feed system, particulate removal system, gas scrubber, and monitoring trains are specified to ensure that the gas exiting the incinerator will have a minimum of pollutants and will not violate any air standards.

The incinerator must be designed, constructed and maintained so that it can meet certain emissions standards. The principal organic hazardous constituents (POHCs) in the waste feed must be treated to the extent that a DRE of 99.99% is achieved. Based upon sampling results, the POHCs will include NB, TNT, TNB, and 2,4-DNT. Particulate emissions must be <180 mg/dry standard m^3 when corrected for the amount of oxygen in the stack gas. In order to ensure that the incinerator meets these standards, the following waste analysis parameters should be monitored: viscosity, heat capacity, the presence of all 40 CFR 261, App. VIII hazardous constituents, halogens, sulfur, and volatile metals.

Periodic analysis of the feed to ensure that anomalies do not occur is relevant and appropriate. It is expected that feed analysis based on a statistical sampling program would be relevant and appropriate to detect feed variations, which can cause a change in the DRE.

Table 6. Action-specific potential ARARs[a] for Alabama Army Ammunition Plant
Alternative 3: On-site incineration/groundwater treatment

Action	Requirements	Prerequisites	Criteria
On-site construction	See Table 4	See Table 4	See Table 4
Excavation	See Table 4	See Table 4	See Table 4
Container storage	See Table 4	See Table 4	See Table 4
Tank storage	See Table 4	See Table 4	See Table 4
Construction of a new landfill	See Table 5	See Table 5	See Table 5
Placement of waste in land disposal unit	See Table 5	See Table 5	See Table 5
Closure with waste in place	See Table 5	See Table 5	See Table 5
Underground injection	See Table 5	See Table 5	See Table 5
Treatment unit	See Table 5	See Table 5	See Table 5
Incineration	Analyze the waste feed.	RCRA[b] hazardous waste.	40 CFR 264.341
	Dispose of all hazardous waste and residues, including ash, scrubber water, and scrubber sludge.		40 CFR 264.351

Table 6. Continued

Actions	Requirements	Prerequisites	Criteria
Incineration (continued)	Performance standards for incinerators: • achieve a destruction and removal efficiency of 99.99% for each principal organic hazardous constituent in the waste feed; • reduce hydrogen chloride emissions to 1.8 kg/h or 1% of the HCl in the stack gases before entering any pollution control devices; and • not release particulate in excess of 180 mg/dscm[c] corrected for amount of oxygen in stack gas.	RCRA hazardous waste.	40 CFR 264.343
	Monitoring of various parameters during operation of the incinerator is required. These parameters include: • combustion temperature, • waste feed rate,		40 CFR 264.347(a)

Table 6. Continued

Actions	Requirements	Prerequisites	Criteria
Incineration (continued)	• an indicator of combustion gas velocity, and • carbon monoxide.		
	Control fugitive emissions either by: • keeping combustion zone sealed or; • maintaining combustion-zone pressure lower than atmospheric pressure.		40 CFR 264.345(d)
	Use automatic cutoff system to waste feed when operating conitions deviate.		40 CFR 264.345(c)
	The incinerator and its associated equipment (pumps, conveyors, valves, pipes, etc.) must be subjected to thorough visual inspections on at least a daily basis, for leaks, spills, fugitive emissions, and signs of tampering.		40 CFR 264.347(b)

Table 6. Continued

Actions	Requirements	Prerequisites	Criteria
Incineration (continued)	The emergency waste feed cut-off system and its associated alarms must be tested at least weekly to verify their operability.		40 CFR 264.347(c)
	This monitoring and inspection data must be recorded and the records must be placed in the operating logs.		40 CFR 264.347(c)
	At closure, all hazardous waste and hazardous waste residues must be removed from the incinerator site.		

[a]ARAR = applicable or relevant and appropriate requirement.
[b]RCRA = Resource Conservation and Recovery Act.
[c]dscm = dry standard cubic meter.

Feed analysis for certain volatile EP metals (As, Cd, Cr, Pb, and Hg) is considered appropriate. Additionally, the stack gas should be monitored for products of incomplete combustion (PICs), CO, NO_x, SO_x, and volatile EP metals. This is done to ensure that the incinerator is functioning properly with complete mixing and burning. These parameters will ensure that both the DRE and air standards will be met. At present, the AAAP area is in attainment for all National Ambient Air Quality criteria. For new sources, Prevention Significant Deterioration (PSD) review is required if the source emits greater than 250 tons per year of any criteria pollutant. Certain criteria pollutants (NO_x, CO, TSP) will be emitted and it is possible that the PSD major source criteria will be violated. Modeling of incinerator emissions to confirm this estimate is recommended. None of the POHCs are on the National Emission Standards for Hazardous Air Pollutants, and, therefore, NESHAP standards need not be considered. It should be noted that poor operating characteristics may result in incomplete combustion of the nitroaromatics with attendant release of benzene or toluene, which are considered under NESHAPs. Additionally, for each waste feed type, a detailed set of operating conditions must be specified and monitored that generally includes: CO level, waste feed rate, combustion temperature, residence time, combustion gas velocity, excess fuel/air requirements, and parameters that initiate the feed cutoff system.

During the startup and shutdown of the incinerator, waste must not be fed into the incinerator unless the incinerator is operating within the specified conditions of operation. A system that automatically terminates the waste feed to the incinerator whenever operating conditions deviate from the established limits is required. The incinerator and its associated equipment must be subjected to thorough visual inspections on at least a daily basis and the emergency waste feed cutoff system and its associated alarms must be tested at least weekly. At a minimum, operational testing must be conducted at least monthly.

Under 40 CFR 264.340(b), incinerators that destroy waste that is listed in 40 CFR 261, Subpart D, solely for corrosivity, ignitability, or reactivity are exempt from all 40 CFR 264, Subpart O, requirements except waste analysis and closure. Accordingly, if it can be demonstrated that the sediments, activated carbon, and associated free liquids are not EP toxic, none of the RCRA incinerator standards previously described are ARARs. Exhaust gas monitoring to ensure compliance with NAAQS and NESHAPs, however, is still considered relevant and appropriate.

At closure, all hazardous waste and hazardous waste residues must be removed from the site, including (but not limited to) ash, scrubber waters and scrubber sludges. The incinerator and all ancillary equipment must be decontaminated prior to removal. Decontamination rinses must be managed as hazardous waste (40 CFR 264.351).

2.3.5 Capping Alternative

Under this alternative, soils/sediments contaminated with explosives or explosives and lead will be removed from Area A to achieve applicable

requirements (unrestricted use criteria, i.e., PPLVs for explosives) and transported and placed in a newly constructed monitored containment structure located in Area B. Further, under this alternative, surficial soils and sediments contaminated with explosives, explosives and lead, and lead only in Area B will be covered with soil to isolate contaminants from direct contact.

The remedial actions for Area A have already been performed and did not include the transportation of any hazardous waste to Area B for disposal and treatment. Therefore, those actions under this alternative that pertain to the treatment of Area A soils were not performed but will be considered. Table 7 lists ARARs for this alternative.

For the capping phase of this action, the prerequisite for jurisdictional applicability is that the RCRA hazardous waste placed at the site after the effective date of the requirements, or placement of hazardous waste into another unit, will make requirements applicable when the waste is being covered with a cap for the purpose of leaving it behind after the remedy is completed. Thus, the capping regulations are not applicable; however, as the waste is a RCRA-listed hazardous waste and this action is similar to the storage, and disposal of hazardous waste, these requirements will be considered relevant and appropriate.

The general requirements for the capping action are set forth in 40 CFR 264.228 (surface impoundments), 40 CFR 264.258 (waste piles), and 40 CFR 264.310 (landfills). These requirements state that the cover must be designed and constructed to provide long-term minimization of migration of liquids through the capped area, function with minimum maintenance, promote drainage and minimize erosion or abrasion of the cover, and accommodate settling and subsidence so that the cover's integrity is maintained. Additionally, to keep water and leachate from collecting in the waste, the cap should have a permeability less than or equal to the permeability of any bottom liner system or natural subsoils present.

In the document *Alabama Army Ammunition Plant Remedial Actions Final Report*, all soils in Area A that were contaminated with hazardous waste had been treated to below levels which require treatment. However, these soils were considered hazardous waste based on being contaminated by listed wastes due to reactivity. Therefore, these ARARs would apply unless these wastes were delisted, which is an administrative procedure not required in ARARs. Even though they are administrative, the steps for delisting would be required to complete this action and would be considered relevant and appropriate.

2.3.6 No Action

For the no-action alternative, there are no action-specific ARARs.

Table 7. Action-specific potential ARARs[a] for Alabama Army Ammunition Plant
Alternative 4: Capping

Actions	Requirements	Prerequisites	Criteria
Capping	Placement of a cap over waste (e.g., closing a landfill, or closing a surface impoundment or waste pile as a landfill, or similar action) requires a cover designed and constructed to: • provide long-term minimization of migration of liquids through the capped area. • function with minimum maintenance; • promote drainage and minimize erosion or abrasion of the cover; • accommodate settling and subsidence so that the cover's integrity is maintained; and • have a permeability less than or equal to the permeability of any bottom liner system or natural subsoils present.	RCRA[b] hazardous waste placed at site after the effective date of the requirements, or placement of hazardous waste into another unit will make requirements applicable when the waste is being covered with a cap for the purpose of leaving it behind after the remedy is completed.	40 CFR 264.258(b) (waste piles) 40 CFR 264.228(a) (surface impoundments) 264.310(a) (landfills)

Table 7. Continued

Actions	Requirements	Prerequisites	Criteria
Capping (continued)	Eliminate free liquids, stabilize wastes before capping.		40 CFR 264.228(a)
	Restrict postclosure use of property as necessary to prevent damage to the cover.		40 CFR 264.117(c)
	Prevent runon and runoff from damaging cover.		40 CFR 264.228(b) (surface impoundments) 40 CFR 264.310(b) (landfills)
	Protect and maintain surveyed benchmarks used to locate waste cells (landfills waste piles).		40 CFR 264.310(b) (landfills)

[a]ARAR - applicable or relevant and appropriate requirement.
[b]RCRA - Resource Conservation and Recovery Act.

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APPENDIX

WORKSHEET 3-1a SCORING FOR INDICATOR CHEMICAL SELECTION: CONCENTRATIONS AND Koc VALUES IN VARIOUS ENVIRONMENTAL MEDIA

CHEMNAME SITE: ala	C/N/B	KOC	H/L	Ground Water (mg/l) Low	High	Repres.	Surface Water (mg/l) Low	High	Repres.
Anthracene	*	1.40E+04							
Benz(a)anthracene	C	1.38E+06							
Benzo(a)pyrene	B	5.50E+06							
Bis(2-Ethylhexyl)phthalate (DEHP)	C								
Cadmium and compounds	N								
Chloroform	B	3.10E+01							
Chromium III and compounds	*								
Chromium VI and compounds	*								
Chrysene	*	2.00E+05							
Copper and compounds	N								
Dibutyl phthalate	N	1.70E+05							
Dichloromethane	N	8.80E+00							
Diethylphthalate	N	1.42E+02							
Dimethyl phthalate	*	1.74E+01							
1,3-Dinitrobenzene	N	1.50E+02							
2,4-Dinitrophenol	N	1.66E+01							
2,4-Dinitrotoluene	B	4.50E+01							
2,6-Dinitrotoluene	N	9.20E+01							
N,N-Diphenylamine	N	4.70E+02							
Ethylbenzene	N	1.10E+03							
Fluoranthene	*	3.80E+04							
Iron and compounds	*								
Lead and compounds (inorganic)	N								
Mercury and compounds (inorganic)	N								
Naphthalene	*	9.40E+02							
Nickel and compounds	B								
Nitrate	*								
Nitrobenzene	*	3.60E+01							
N-Nitrosodiphenylamine	*	6.48E+02							
Polychlorinated biphenyls (PCBs)	B	5.30E+05							
Pyrene	*	3.80E+04							
Trinitrotoluene (TNT)	*								
Zinc and compounds	N								

WORKSHEET 3-1b SCORING FOR INDICATOR CHEMICAL SELECTION: CONCENTRATIONS AND Foc VALUES IN VARIOUS ENVIRONMENTAL MEDIA

CHEMNAME SITE: ala	C/N/B	KOC	H/L	Soil (mg/kg) Low	Soil (mg/kg) High	Soil (mg/kg) Repres.	Sediment (mg/kg) Low	Sediment (mg/kg) High	Sediment (mg/kg) Repres.
Anthracene	*	1.40E+04		0.1200	0.1800	0.1500		0.2400	0.2400
Benz(a)anthracene	C	1.38E+06			1.7000	1.7000	0.4800	1.0999	0.7899
Benzo(a)pyrene	B	5.50E+06			0.7899	0.7899			
Bis(2-Ethylhexyl)phthalate (DEHP)	C			0.7000	10.9999	3.6924	0.0840	7.3000	1.5088
Cadmium and compounds	N						2.8850	6.4990	4.6920
Chloroform	B	3.10E+01							
Chromium III and compounds	*			6.4070	58.3799	21.1720	10.9399	100.1999	32.7917
Chromium VI and compounds	*			6.4070	58.3799	21.1720	10.9399	100.1999	32.7917
Chrysene	*	2.00E+05			1.0999	1.0999	0.1100	0.7899	0.3600
Copper and compounds	N			8.5980	1425.9990	49.6142	8.7680	787.9999	97.5164
Dibutyl phthalate	N	1.70E+05		0.4300	2.9000	1.6650	0.0970	4.5000	0.9096
Dichloromethane	N	8.80E+00							
Diethylphthalate	N	1.42E+02		1.3000	7.1999	4.2500	0.0980	4.8999	1.6182
Dimethyl phthalate	*	1.74E+01			0.1300	0.1300			
1,3-Dinitrobenzene	N	1.50E+02		0.2200	2.0000	0.6584	0.2992	50.8999	25.5995
2,4-Dinitrophenol	N	1.66E+01							
2,4-Dinitrotoluene	B	4.50E+01		0.1170	15.9999	1.6453	0.1397	5.6700	1.1549
2,6-Dinitrotoluene	N	9.20E+01		0.1490	16.0999	2.2257	0.1787	1.8470	0.5970
N,N-Diphenylamine	N	4.70E+02		24.1199	24.1199	24.1199			
Ethylbenzene	N	1.10E+03							
Fluoranthene	*	3.80E+04			1.5999	1.5999	0.2000	1.5999	0.8999
Iron and compounds	*			20069.9999	69440.0000	41611.6200	35579.9999	88639.9999	53788.5700
Lead and compounds (inorganic)	N			6.7400	14740.0000	356.3180	10.7899	222.9999	51.6520
Mercury and compounds (inorganic)	N			0.3019	0.3699	0.3403	0.4010	0.5527	0.4768
Naphthalene	*	9.40E+02						0.2500	0.2500
Nickel and compounds	B			8.6390	41.6199	15.9798	12.8599	461.9000	62.2580
Nitrate	*				7.2369	7.2369	6.1300	7.6120	6.8710
Nitrobenzene	*	3.60E+01		0.5290	0.5389	0.5340	0.5574	50.7899	25.6740
N-Nitrosodiphenylamine	*	6.48E+02					0.3200	0.5000	0.4167
Polychlorinated biphenyls (PCBs)	B	5.30E+05		0.2250	0.8419	0.5334			
Pyrene	*	3.80E+04		1.0999	6.1999	3.6499	0.1800	1.0000	0.5900
Trinitrotoluene (TNT)	*			0.0794	7899.9999	568.8230	0.0860	16.4599	3.7716
Zinc and compounds	N			201.6999	393.3000	261.2250	200.8999	1068.0000	634.4500

WORKSHEET 3-2 SCORING FOR INDICATOR SELECTION: TOXICITY INFORMATION

CHEMNAME SITE: ala	TOX CLASS	WT	ST
Anthracene	*		
Benz(a)anthracene	PC	5.81E-01	2.91E-05
Benzo(a)pyrene	PC	4.55E+00	2.28E-04
	NC	2.68E-02	1.34E-06
Bis(2-Ethylhexyl)phthalate (DEHP)	PC	5.71E-04	2.86E-08
Cadmium and compounds	NC	3.59E+01	1.79E-03
Chloroform	PC	5.63E-02	2.81E-06
	NC	4.43E-02	2.21E-06
Chromium III and compounds	*		
Chromium VI and compounds	*		
Chrysene	*		
Copper and compounds	NC	7.14E-01	3.57E-05
Dibutyl phthalate	NC	3.81E-02	1.90E-06
Dichloromethane	NC	9.20E-04	4.60E-08
Diethylphthalate	NC	2.67E-04	1.34E-08
Dimethyl phthalate	*		
1,3-Dinitrobenzene	NC	4.43E+00	2.22E-04
2,4-Dinitrophenol	NC	1.14E+00	5.71E-05
2,4-Dinitrotoluene	PC	1.09E-01	5.46E-06
	NC	3.03E-01	1.51E-05
2,6-Dinitrotoluene	NC	3.03E-01	1.51E-05
N,N-Diphenylamine	NC	2.35E-02	1.17E-06
Ethylbenzene	NC	1.10E-02	5.52E-07
Fluoranthene	*		
Iron and compounds	*		
Lead and compounds (inorganic)	NC	8.93E-01	4.46E-05
Mercury and compounds (inorganic)	NC	1.84E+01	9.21E-04
Naphthalene	*		
Nickel and compounds	PC	2.29E-01	1.15E-05
	NC	4.26E+00	2.13E-04
Nitrate	*		
Nitrobenzene	*		
N-Nitrosodiphenylamine	*		
Polychlorinated biphenyls (PCBs)	PC	1.44E+00	7.20E-05
	NC	9.33E+01	4.67E-03
Pyrene	*		
Trinitrotoluene (TNT)	*		
Zinc and compounds	NC	1.07E-01	5.33E-06

WORKSHEET 3-3 SCORING FOR INDICATOR CHEMICAL SELECTION: CALCULATION OF CT AND IS VALUES FOR CARCINOGENIC EFFECTS

CHEMNAME SITE: ala	Gnd Water C*T		Surf Water C*T		Soil C*T		IS Value		Tent. Rank	
	Max.	Rep.	Max.	Rep.	Max.	Rep.	Max.	Rep.	Max.	Rep.
Benz(a)anthracene	0.000000	0.000000	0.000000	0.000000	0.000049	0.000049	0.0000495	0.0000495	5	3
Benzo(a)pyrene	0.000000	0.000000	0.000000	0.000000	0.000180	0.000180	0.0001801	0.0001801	2	2
Bis(2-Ethylhexyl)phthalate	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000003	0.0000001	6	6
Chloroform	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000000	0.0000000	7	7
2,4-Dinitrotoluene	0.000000	0.000000	0.000000	0.000000	0.000087	0.000009	0.0000874	0.0000090	3	5
Nickel and compounds	0.000000	0.000000	0.000000	0.000000	0.000479	0.000184	0.0004786	0.0001838	1	1
Polychlorinated biphenyls (	0.000000	0.000000	0.000000	0.000000	0.000061	0.000038	0.0000606	0.0000384	4	4

WORKSHEET 3-4 SCORING FOR INDICATOR CHEMICAL SELECTION: CALCULATION OF CT AND IS VALUES FOR NON-CARCINOGENIC EFFECTS

CHEMNAME SITE: ala	Gnd Water C*T		Surf Water C*T		Soil C*T		IS Value		Tent. Rank	
	Max.	Rep.	Max.	Rep.	Max.	Rep.	Max.	Rep.	Max.	Rep.
Benzo(a)pyrene	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001	0.0000011	0.0000011	12	12
Cadmium and compounds	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000000	0.0000000	18	18
Chloroform	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000000	0.0000000	17	17
Copper and compounds	0.000000	0.000000	0.000000	0.000000	0.050908	0.001771	0.0509082	0.0017712	2	4
Dibutyl phthalate	0.000000	0.000000	0.000000	0.000000	0.000006	0.000003	0.0000055	0.0000032	11	11
Dichloromethane	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000000	0.0000000	15	15
Diethylphthalate	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000001	0.0000001	13	13
1,3-Dinitrobenzene	0.000000	0.000000	0.000000	0.000000	0.000444	0.000146	0.0004440	0.0001462	6	7
2,4-Dinitrophenol	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000000	0.0000000	14	14
2,4-Dinitrotoluene	0.000000	0.000000	0.000000	0.000000	0.000242	0.000025	0.0002416	0.0000248	9	10
2,6-Dinitrotoluene	0.000000	0.000000	0.000000	0.000000	0.000243	0.000034	0.0002431	0.0000336	8	8
N,N-Diphenylamine	0.000000	0.000000	0.000000	0.000000	0.000028	0.000028	0.0000282	0.0000282	10	9
Ethylbenzene	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000000	0.0000000	16	16
Lead and compounds (inorgan	0.000000	0.000000	0.000000	0.000000	0.657404	0.015892	0.6574040	0.0158918	1	1
Mercury and compounds (inor	0.000000	0.000000	0.000000	0.000000	0.000341	0.000313	0.0003407	0.0003134	7	6
Nickel and compounds	0.000000	0.000000	0.000000	0.000000	0.008865	0.003404	0.0088650	0.0034037	3	2
Polychlorinated biphenyls (	0.000000	0.000000	0.000000	0.000000	0.003932	0.002491	0.0039317	0.0024910	4	3
Zinc and compounds	0.000000	0.000000	0.000000	0.000000	0.002096	0.001392	0.0020963	0.0013923	5	5

WORKSHEET 3-5a SCORING FOR INDICATOR CHEMICAL SELECTION: POTENTIAL CARCINOGENS

CHEMNAME SITE: ala	IS Value Max.	IS Value Rep.	Tent. Max.	Rank Rep.	WATERSOL	VAPPRESS	HENRY	LOGKOW	FISHBCF	HLSOILL	HLSOILH	HLSURWATL	HLSURWATH
Nickel and compounds	0.0004786	0.0001838	1	1		0.00E+00	NA		47				
Benzo(a)pyrene	0.0001801	0.0001801	2	2	1.20E-03	5.60E-09	1.55E-06	6.06		420.	480.	0.40	-
Benz(a)anthracene	0.0000495	0.0000495	5	3	5.70E-03	2.20E-08	1.16E-06	5.60				1.00	5.00
Polychlorinated biphenyls	0.0000606	0.0000384	4	4	3.10E-02	7.70E-05	1.07E-03	6.04	100000			2.00	12.90
2,4-Dinitrotoluene	0.0000874	0.0000090	3	5	2.40E+02	5.10E-03	5.09E-06	2.00	3.8			3.00	10.00
Bis(2-Ethylhexyl)phthalat	0.0000003	0.0000001	6	6		2.00E-07							
Chloroform	0.0000000	0.0000000	7	7	8.20E+03	1.51E+02	2.87E-03	1.97	3.75			0.30	30.00

WORKSHEET 3-5b SCORING FOR INDICATOR CHEMICAL SELECTION: NON-CARCINOGENS

CHEMNAME SITE: ala	IS Value Max.	IS Value Rep.	Tent. Max.	Rank Rep.	WATERSOL	VAPPRESS	HENRY	LOGKOW	FISHBCF	HLSOILL	HLSOILH	HLSURWATL	HLSURWATH
Lead and compounds (inorg	0.6574040	0.0158918	1	1		0.00E+00	NA		49			PERS	-
Nickel and compounds	0.0088650	0.0034037	3	2		0.00E+00	NA		47				
Polychlorinated biphenyls	0.0039317	0.0024910	4	3	3.10E-02	7.70E-05	1.07E-03	6.04	100000			2.00	12.90
Copper and compounds	0.0509082	0.0017712	2	4		0.00E+00	NA		200				
Zinc and compounds	0.0020963	0.0013923	5	5		0.00E+00	NA		47			PERS	-
Mercury and compounds (in	0.0003407	0.0003134	7	6		2.00E-03	NA		5500			PERS	-
1,3-Dinitrobenzene	0.0004440	0.0001462	6	7	4.70E+02		NA	1.62					
2,6-Dinitrotoluene	0.0002431	0.0000336	8	8	1.32E+03	1.80E-02	3.27E-06	2.00	3.8				
N,N-Diphenylamine	0.0000282	0.0000282	10	9	5.76E+01	3.80E-05	1.47E-07	3.60	30				
2,4-Dinitrotoluene	0.0002416	0.0000248	9	10	2.40E+02	5.10E-03	5.09E-06	2.00	3.8			3.00	10.00
Dibutyl phthalate	0.0000055	0.0000032	11	11	1.30E+01	1.00E-05	2.82E-07	5.60					
Benzo(a)pyrene	0.0000011	0.0000011	12	12	1.20E-03	5.60E-09	1.55E-06	6.06		420.	480.	0.40	-
Diethylphthalate	0.0000001	0.0000001	13	13	8.96E+02	3.50E-03	1.14E-06	2.50	117				
2,4-Dinitrophenol	0.0000000	0.0000000	14	14	5.60E+03	1.49E-05	6.45E-10	1.50	0				
Dichloromethane	0.0000000	0.0000000	15	15	2.00E+04	3.62E+02	2.03E-03	1.30	5			1.20	5.80
Ethylbenzene	0.0000000	0.0000000	16	16	1.52E+02	7.00E+00	6.43E-03	3.15	37.5			1.50	7.50
Chloroform	0.0000000	0.0000000	17	17	8.20E+03	1.51E+02	2.87E-03	1.97	3.75			0.30	30.00
Cadmium and compounds	0.0000000	0.0000000	18	18		0.00E+00	NA		81			PERS	-